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# Democracy, electoral systems and emissions: explaining when and why democratization promotes mitigation

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## ABSTRACT

Does democratization help countries mitigate climate change? On the one hand, by increasing the value placed on quality of life, creating more opportunity for environmental actors to influence policymaking and holding elected politicians accountable, an increase in democratic institution and process should promote emissions reduction. On the other hand, the desire to safeguard individual freedom presumably brings with it an aversion to intervene in lifestyle and market decisions, thereby raising the risk of climate inaction. This outcome is further encouraged by the political need to balance (conflicting) environmental and energy interests.

This article evaluates the thesis that democratization promotes mitigation in light of national emissions levels from 1990 to 2012. Using data from the Freedom House, Polity IV and V-Dem indices, World Bank World Development Indicators and the World Resources Institute Climate Data Explorer it conducts a large-N investigation of the emissions levels of 147 countries. Although several quantitative studies have found that domestic political regimes affect emissions levels, this article goes beyond existing research by building a more sophisticated – multilevel- research design to determine whether democracy: (a) continues to be an important driver of emissions when country-level clustering is accounted for and (b) has uniform effects across countries. The results indicate that, even after controlling for country-level clustering and holding constant the other confounding factors, democracy is indeed a significant driver. More strikingly, they reveal that while democracies tend to have lower emissions than non-democracies, democratization spells within the same country do not have the same kind of inhibitory effects as they do between countries. This article also finds tentative evidence that the type of electoral system plays a critical role in shaping the effect of democratization on individual countries.

## Key policy insights

- Democracies tend to perform better in terms of emission levels than non-democracies.
- Democratization has non-uniform effects across different countries, with the type of electoral system playing a key role in determining the effect that democratization has on national emissions.
- Further research is needed to develop our understanding of how the political context influences emissions, especially with regard to the influence of pro and anti-decarbonisation actors.

## ARTICLE HISTORY

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## KEYWORDS

Emission projections; political processes; mitigative capacity; least developed countries (LDCs); CO<sub>2</sub> emissions; electoral system

## Introduction

Shortly before being elected Vice President in 1992, Al Gore (1992, p. 179) described ‘the spread of democratic government to more nations of the world ... [as] an essential prerequisite for saving the environment’. Around

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about the same time, scholars of environmental politics began evaluating this claim empirically, identifying several reasons why democracies should perform better at environmental quality (e.g. Berge, 1994; Congleton, 1992; Kotov & Nikitina, 1995; Schultz & Crockett, 1990; Weiss & Jacobsen, 1999). But does democratization play a role in combatting the most challenging international environmental issue to date – climate change? In the climate politics literature, the relationship between democracy and emissions is largely based on the assumption of positive effect (Burnell, 2012, 2014). According to this approach, democracies should excel at mitigation because of the higher value they place on human life (Cole & Neumayer, 2005), increased opportunity they provide to environmental actors to influence policymaking (Schultz & Crockett, 1990) and accountability of elected politicians to their publics (Farzin & Bond, 2006; Kotov & Nikitina, 1995; Li & Reuveny, 2006). Collectively, these arguments suggest that an increase in democratic institutions and process, which this article refers to interchangeably as democratization, should promote mitigation.

Yet empirical research suggests that such optimism might be misfounded. Indeed, while democracies tend to make more promises to reduce emissions than autocracies, they are not usually better at keeping them (Battig & Bernauer, 2009; Bohmelt, Boker, & Ward, 2016; Burnell, 2012). The thesis is also undermined by the fact that some of the world's leading democracies have also been laggards in climate mitigation. Climate experts have responded to this puzzle by seeking to develop a better understanding of the relationship between democracy and mitigation. Explanations have been suggested as to why democracies might find it difficult to reduce emissions. Battig and Bernauer (2009), for example, suggest that this stems from a democratic aversion to restricting individual freedom, particularly in the transport sector. Others have asked whether it is a certain aspect of democracy, such as their level of inclusiveness (Bohmelt et al., 2016) or type of electoral system (Bohmelt et al., 2016; Fredriksson, Matschke, & Minier, 2010; Fredriksson & Wollscheid, 2007; Harrison & Sundstrom, 2010), rather than democracy per se, which has a positive effect on mitigation.

This article contributes to this literature by interrogating whether a country's accumulated 'democratic stock'<sup>1</sup> (Gallagher & Strom, 2008 and Fredriksson & Neumayer, 2013) and type of electoral system influence the effect that democratization has on mitigation performance. Using data from the World Resources Institute Climate Data Explorer, World Bank Development Indicators, International Monetary Fund Export Diversification Database, United Nations Population Division, Freedom House (FH) Freedom Index, Polity II variable of the Polity IV database and recently developed V-Dem index, it conducts a large-N investigation of the emissions levels of 147 countries from 1990 to 2012, while accounting for interstate differences in the main emissions drivers such as population size, economic growth, export diversity, technology and emissions decoupling. Although several quantitative studies have found that domestic political regimes affect emissions levels (e.g. Battig & Bernauer, 2009; Bernauer & Bohmelt, 2013; Bohmelt et al., 2016; Gallagher & Strom, 2008; von Stein, 2008), most quantitative work focuses on cross-sectional differences between countries, which creates the possibility that observed differences in emissions levels might be due to other (non-modelled) factors that vary between countries rather than the level of democracy. In contrast, this article employs multilevel modelling to isolate the effect of democracy – or fluctuations in the level of democracy in domestic political regimes – within the same country. In this way, it provides a more robust test of the democracy thesis as it evaluates whether democracy continues to be a significant driver of emissions once country-level clustering is explicitly accounted for. It also arrives at a more sophisticated understanding about the influence of democracy on emissions by building a random coefficient model that allows the effect of democratization to vary between countries. This is especially important for identifying the potentially adverse effects of democratization on climate outcomes, particularly in relation to the type of political regime already in place.

The results of this article provide strong evidence that democratization has distinct, and often contradictory, effects between and within countries: while emissions levels tend to decline as one moves from closed to relatively more democratic countries, an increase in democratic quality within the same country usually has a much weaker inhibitory effect on emissions (and sometimes even boosts emissions). The findings also suggest that the effect of democracy on emissions varies significantly between different types of electoral system: inhibiting emissions in majoritarian-presidential systems, but boosting emissions in proportional-parliamentary and hybrid systems.

This article consists of five sections. The next section reviews the literature on democracy and mitigation to draw out the main arguments that have been made regarding the influence of democracy on emissions. Section two outlines the research design by discussing the spatial-temporal domain, testing strategy and

operationalization. The third section presents the results of the empirical analysis and runs a series of regional simulations to illustrate the likely effects of democratization on the key geopolitical groups in the multilateral climate negotiations. Section four evaluates the robustness of the findings by repeating the analysis with a series of alternative democracy metrics and disaggregating the effect of democratization on different types of democratic electoral system. The article concludes by discussing the theoretical contributions and policy relevance of the findings.

## Democracy and emissions levels

A casual reader of International Relations literature could be forgiven for thinking that there is not much that democracy cannot do. From war and peace (Kant, 1983) to economic development (Helliwell, 1994), free trade (Dai, 2006) and poverty alleviation (Ross, 2006), democratization is often heralded as the solution to some of the world's most pressing problems. Unsurprisingly, then, the claim that democracy has a positive effect on environmental quality has gained a large following in environmental politics, with promising effects reported in several areas (e.g. Barrett & Graddy, 2000; Torras & Boyce, 1998). However, the accumulation of contradictory empirical findings (e.g. Congleton, 1992; Midlarsky, 1998; Scruggs, 1998) and recent emergence of a more critical attitude towards democratization outside the environmental sector (e.g. Carothers, 2007, 2010) have given rise to a different set of arguments contending that democracy also has the potential to adversely affect the environment. Building on the work of a small but expanding body of scholarship (e.g. Battig & Bernauer, 2009; Böhmelt, Bernauer, & Koubi, 2015; Burnell, 2012, 2014; Farzin & Bond, 2006; Gallagher & Strom, 2008; Hobson, 2012; Neumayer & Fredriksson, 2013), this section argues that these positive and negative assessments of the impact of democracy help explain why certain countries are more (or less) willing to undertake emissions reductions to mitigate climate change.

The effect of democracy on emissions can be theorized by focusing on four core distinctions between democracies and non-democracies, namely: ideational values, electoral accountability, the opportunity for free expression and time horizons. First, owing to their core ideational values, democracies are said to have more respect for the rule of law, which should make them more likely to comply with commitments under international environmental treaties (Weiss & Jacobsen, 1999) such as, for example, the Kyoto Protocol (Battig & Bernauer, 2009; von Stein, 2008). A related argument is that democracies allegedly place higher value on human life and quality of life, which makes them more accepting of effective climate policy (Burnell, 2012; Li & Reuveny, 2006). Yet some authors have found that this heightened respect for the individual has a detrimental effect on mitigation because, relative to authoritarian regimes, democracies are less willing to intervene in the markets and regulate lifestyle decisions (Battig & Bernauer, 2009). Autocracies, on the other hand, are presumably more comfortable regulating individual behaviour (Beeson, 2010; Hobson, 2012).

Second, because the fear of being voted out of office creates a strong motive to deliver, electoral accountability is widely regarded to make democracies more responsive to the demands of their publics (Kotov & Nikitina, 1995). Therefore, when faced with an equal demand for a safe climate, democratic governments should be more willing to implement effective mitigation policies than non-democracies (Burnell, 2012, 2014). However, as some authors (e.g. Battig & Bernauer, 2009; Farzin & Bond, 2006) point out, it is not clear that climate change awareness or the demand for mitigation is higher in democracies. Furthermore, the desire to please the electorate raises the risk of political deadlock and inaction in the climate sector, where environmental and corporate and energy interests often collide (Midlarsky, 1998).

Third, by promoting freedom of expression and providing more opportunity for civil society activity, democracies are believed to enable environmental interests to exert greater influence over environmental policymaking (Battig & Bernauer, 2009; Schultz & Crockett, 1990; von Stein, 2008). However, freedom of expression brings with it the possibility that anti-environmental interests such as energy lobbies and corporate actors could more easily block mitigation. Indeed, the effect of democratic pluralism on empowering influential interest groups has been found to obstruct the provision of other public goods (Midlarsky, 1998). Thus whether freedom of expression has a positive or negative effect on mitigation is likely to be determined by the country's industrial composition; a high proportion of domestic carbon-intensive industry will presumably generate greater resistance to unilateral emissions reduction, which is perceived by such industries as undermining their

**Table 1.** Regime attributes and pathways through which democracy affects mitigation.

| Attribute   | Positive pathway  | Negative pathway   |
|---|---|--|
| Ideational values   | Democracies place higher value on human life, life quality and the rule of law, making them more likely to adopt effective climate policy.  | Democracies are reticent to restrict individual freedoms and intervene in the market, whereas authoritarian regimes are more comfortable intervening in individual behaviour, creating stronger control over emissions levels.           |
| Electoral accountability                                      | The fear of not being re-elected makes policymakers eager to please their publics by, for example, implementing effective climate policy.   | The desire to please conflicting interests in democracies leads to political standstill and environmental inaction.  |
| Freedom of expression, opportunity for civil society activism | Environmental interests are more likely to be voiced and penetrate policymaking in democracies in countries wherein a high proportion of industry specializes in low carbon-intensity activity. | Anti-environmental interests such as energy lobbies and businesses can block mitigation in democracies, which is likely in countries wherein a high proportion of industry specializes in high carbon-intensity activity.                |
| Time horizons   | Autocracies employ coercive measures to remain in power, diverting resources away from long-term policies such as mitigation.   | Authoritarian leaders have greater expectation of being in power long enough to reap the benefits of effective climate policy whereas elected policymakers are likely to be out of office before the benefits of mitigation materialize. |

Note: Pathways describe the effect on mitigation policy.

competitiveness (Aldy & Pizer, 2015). In contrast, countries whose industries specialize in low carbon-intensive activity are likely to host more companies that stand to gain from their capacity to invest in more efficient, low-energy practices at relatively lower opportunity costs. While the outcome arising from a country's domestic industrial composition is likely to hold irrespective of the level of democracy in a country, governments and corporate actors in countries with high carbon-intensive industries are more likely to thwart the emergence of sustainable advocacy movements that are presumably cultivated by the democratization process (Aklin & Urpelainen, 2013). On the other hand, the transition to democratic pluralism is likely to promote mitigation policy in countries with low carbon-intensity as domestic companies invested in low-carbon products are likely to gain greater influence compared to the autocratic phase.<sup>2</sup>

Fourth, because the chief priority of ruling elites in autocracies is to remain in power, they are more likely to divert limited resources away from long-term issue-areas such as climate change to coercive measures that seek to ensure they remain in power short-term (Congleton, 1992; Fredriksson & Neumayer, 2013; Li & Reuveny, 2006). Yet there is a strong counter-argument to be made that democracies might suffer from another kind of myopic bias that obstructs mitigation: the expectation of regular elections means that most elected policymakers do not expect to remain in office by the time that the long-term benefits of mitigation materialize. Authoritarian leaders, on the other hand, often have longer time horizons and can therefore reasonably expect to take credit for effective climate policy, thereby creating a distinct impetus for mitigation in closed political systems (Burnell, 2012; Hobson, 2012).

These four attributes and the associated pathways through which democracy is theorized to affect emissions levels are summarized in Table 1.

## Research design

This article uses cross-section time series data to analyse the absolute emissions levels of 147 countries from 1990 to 2012. This temporal domain captures a series of important developments in climate politics. Climate change entered the political agenda in 1990 and became the subject of various foundational international conferences and agreements such as the 1992 United Nations Framework Convention on Climate Change (UNFCCC) and 1997 Kyoto Protocol (KP) over the following decade. Efforts to bring the KP into force in 2005 ushered in a period of more intense international debate and division as Annex I parties (developed countries) went on to achieve their collective emissions target over the first commitment period, despite the withdrawal of the US from the KP in 2001. 2012 marks the end of the first commitment period and adoption of the second commitment period, which has yet to enter into force. Although Annex I parties have declared voluntary pledges under

the Copenhagen Accord and Cancun Agreements, the absence of internationally binding emissions targets presumably removed an important pressure on mitigation, making 2012 an appropriate cut-off point.

The unit of analysis is the country-year, where one observation represents the total CO<sub>2</sub> emissions level of a country in a given year, bringing the total number of observations to 3,381. The geographical spread of the dataset was cast as widely as possible in order to minimize the risk of drawing conclusions from correlations that are due to regional attributes rather than democratic qualities. The baseline criterion for excluding a country was missing data for two or more independent variables across the temporal period under investigation. The resulting mix of countries in the sample spans eight geopolitical regions which provides a good representation of the major negotiating blocks in the multilateral climate negotiations – namely: the EU, Umbrella Group (UG – non-EU developed states), BASIC (Brazil, South Africa, India and China), middle-income developing countries (MIDCs),<sup>3</sup> Least Developed Countries (LDCs) and Alliance of Small Island States (LDCs and AOSIS), Organisation of Petroleum Exporting Countries (OPEC) and Central Asia, Caucasus, Albania and Moldova (CACAM).<sup>4</sup>

Most quantitative work in the field employs ordinary least squares (OLS) regression to study emissions (e.g. Battig & Bernauer, 2009; Bernauer & Bohmelt, 2013; von Stein, 2008). Yet, as Clulow (2018) argues elsewhere, the hierarchical structure of emissions behaviour violates the critical independence assumption that is central to OLS regression. The fundamental assertion behind this claim is that emissions levels from the same country are more likely to be similar than emissions levels from different countries, which results in a two-level data structure whereby country-years are nested in countries. Table A1 in the technical appendix presents statistical evidence behind this claim and shows that 91.4% of the total variance in the emissions levels included in the sample occurs between different countries.

Table 2 summarises the variables and data sources. CO<sub>2</sub> is the largest contributor to climate change and CO<sub>2</sub> emissions data are the most reliable. For these reasons, this article uses CO<sub>2</sub> levels to measure annual national emissions levels, which is captured by EMLEVEL. Emissions values range from near zero to 9312 MtCO<sub>2</sub>e and are taken from the World Resources Institute *Climate Data Explorer* (CDE) database.

Data for democracy come from the FH democracy Index, which assigns scores from a six-point scale to denote the level of political rights and civil liberties in a country in a given year. These scores were inverted to aid interpretation of the democracy coefficient so that high (low) values correspond to high (low) levels of democracy and multiplied by ten to increase the spread of scores. Since variables are centred, a score of zero corresponds to the average level of democracy across all countries and years in the sample. DEM scores range from –22.6 to 37.4, denoting the lowest and highest levels of democracy ever recorded in a country respectively.

In order to isolate the effect of democracy on emissions levels from the influence of other factors, the models introduce several variables to hold constant the other main putative drivers, namely: per capita GDP, export diversity, annex status under the KP, dependency on income derived from fossil fuels, renewable technology, population growth and emissions decoupling, which allows for fair comparisons between countries that possess different socio-economic, geophysical, political and demographic characteristics. Full details of the control variables are given in the technical appendix.<sup>5</sup> Accounting for these variables renders the predicted changes in absolute emissions levels comparable across countries as coefficient estimates denote the average democratization effect that is likely to take place if all countries possessed the same values for all of

**Table 2.** Variables.

| Variable  | Definition  | Source   |
|-----------|---|--|
| EMLEVEL   | Annual CO <sub>2</sub> emissions in a given country (MtCO <sub>2</sub> e)                     | World Resource Institute Climate Data Explorer                                       |
| DEM       | Level of democracy in a country in a given year   | Freedom House Freedom Index  |
| GDP       | Per capita GDP (in 1000s US\$)  | World Bank Development Indicators  |
| EXPORTDIV | Level of export diversification in the national economy                                       | International Monetary Fund Export Diversification Database                          |
| ANNEX     | Annex status in the climate regime  | Annex listings under the KP  |
| FFDEP     | Percentage of GDP dependent on fossil fuel income   | World Bank Development Indicators  |
| TECH      | Annual proportion of renewable energy consumption as a percentage of total energy consumption | World Bank Development Indicators  |
| POP       | National population level in a given year   | United Nations Population Division Database  |
| EMDECOUP  | The ratio of change in CO <sub>2</sub> emissions to change in GDP                             | World Resource Institute Climate Data Explorer and World Bank Development Indicators |

the control variables that are included in the model (and, for the multilevel models, all of the other country-level variables that are not explicitly included as controls).

Several studies have found that corruption dampens the positive effect of democracy on environmental policy and outcomes (by, for example, obstructing the usual democratic process through which environmental NGOs influence policy).<sup>6</sup> Data from the Worldwide Governance Indicators corruption index were included in diagnostic tests to control for the influence of corruption over emissions. Although the coefficients were significant at the 0.001 level and absorbed some of the effect sizes of the independent variables, the results did not change the signs of the democracy coefficients or substantively alter the interpretation of the results that are reported below. Therefore, corruption was not included as a control variable.

The next section begins by setting up a single-level multivariate regression that incorporates all of the variables from Table 2. It then gradually models the hierarchical data structure in two stages. It begins by setting up a random intercept model (RIM), which differentiates between observations according to their country and, then, builds a random coefficient model (RCM), which allows the effects of democracy to vary between countries. Full details of the models and testing strategy are given in the technical appendix.

## Results

Table 3 summarises the empirical results. The first column displays the estimates of the multivariate OLS regression, which represents the dominant quantitative approach in the field. This model indicates that the average country emits 78.23 MtCO<sub>2</sub>e per year. Consistent with the conventional - optimistic - approach, these results suggest that, on average and while keeping constant the other main drivers such as population, economic activity, fossil fuel dependency, technology and emissions decoupling, a one-point increase in the FH democracy index is associated with a 84.87 Mt decline in CO<sub>2</sub> emissions.<sup>7</sup> This finding is highly significant, both substantially and statistically; the effect size is around one and a quarter of one standard deviation of national emissions levels (651 points) and the coefficient is significant at the 0.001 level. If the analysis were to end here, then, the conclusion would be overwhelmingly positive and in accordance with hypothesis that democratization promotes mitigation.

**Table 3.** Effects of democracy and potentially confounding factors on emissions levels.

| Parameter                   | Model 1 OLS                  | Model 2 RIM              | Model 3 RCM               |
|-----------------------------|------------------------------|--------------------------|---------------------------|
| <i>Fixed effects</i>        |                              |                          |                           |
| Intercept                   | 78.24 (27.12)**              | 307.25 (66.62)***        | 416.56 (168.00)*          |
| DEM                         | -8.49 (0.96)***              | 1.79 (0.65)**            | 5.24 (4.07)               |
| Per capita GDP              | 1.16 (1.67)                  | 1.62 (0.82)*             | 1.43 (0.69)*              |
| EXPORTDIV                   | 1.82 (0.12)***               | 0.08 (0.10)              | 0.03 (0.09)               |
| ANNEX                       | -0.21 (0.53)                 | 1.48 (1.48)              | 2.92 (3.95)               |
| FFDEP                       | -1.72 (1.23)                 | 0.95 (0.67)              | 1.00 (0.58)               |
| TECH                        | 2.53 (0.53)***               | -2.61 (0.63)***          | -2.45 (0.56)***           |
| POP                         | 0.17 (1.46)                  | -2.22 (0.77)**           | -1.20 (0.67)              |
| EMDECOUP                    | 0.35 (0.71)                  | 0.02 (0.20)              | 0.01 (0.16)               |
| <i>Random effects</i>       |                              |                          |                           |
| DEM random effect ( $u_1$ ) | -                            | -                        | 1654.38 (248.51)***       |
| Country variance            | -                            | 467239.90 (60688.42)***  | 3211564.00 (442387.1)***  |
|                             |                              | R <sup>2</sup> : -20.90% | R <sup>2</sup> : -731.00% |
| Country-year variance       | 650.83 (11.14)***            | 31551.91 (958.88)***     | 19386.13 (612.27)***      |
|                             | Adj. R <sup>2</sup> : 11.98% | R <sup>2</sup> : 13.18%  | R <sup>2</sup> : 46.65%   |
| LR test <sub>OLS</sub>      | -                            | 5240.71***               | 5697.74***                |
| LR test <sub>Null</sub>     | -                            | 15575.60***              | 16032.64***               |
| LR test <sub>RIM</sub>      | -                            | -                        | 457.03***                 |

Note: Single-level entries are ordinary least squares estimates and multilevel entries are maximum likelihood estimates with estimated standard errors in parentheses. In accordance with Snijders and Bosker (1994), the null variance components were used to calculate the percentage of explained variance at the country and country-year levels, which is the equivalent to having a separate R-squared value for each level of the hierarchical model. Negative R-squared values in the RIM and RCM indicate an increase in the amount of unexplained variance at the country-year level and are attributable to the increased heterogeneity (random intercepts and coefficients) that is captured by the multilevel models.

\*Significant at 5% ( $p < 0.05$ ).

\*\*Significant at 1% ( $p < 0.01$ ).

\*\*\* Significant at 0.01% ( $p < 0.001$ ).

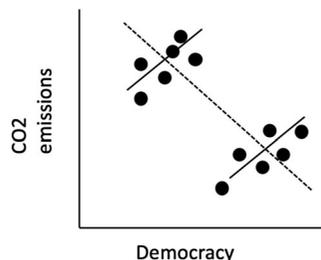
Do the results change when the hierarchical data structure is modelled? This question can be answered by comparing the OLS results with the results of the RIM, which differentiates between observations of emissions levels based on their country of origin. Crucially, by estimating coefficients based on the mean effects on emissions levels from the same country, this model entails a stronger test of the democracy thesis as it indicates whether the desirable effect of democracy on emissions that was found in the first model is robust to country-level clustering.

Accounting for country-level clustering shows that, contrary to the results of the OLS model, democratization spells within the same country, which may or may not be reversed in subsequent years, are associated with higher emissions. In the RIM, a one-point increase in the FH democracy index is associated with a 17.9 Mt increase in CO<sub>2</sub> emissions, suggesting incompatibility with mitigation. This effect is significant at the 0.001 level, although it should be noted that the magnitude of the effect is only around a quarter of the (absolute) effect reported in the OLS.

The transformation of the sign of the democracy coefficient that occurs on moving from the single model to the RIM indicates that democracy has contradictory effects between and within countries – a phenomenon that is known as cluster-confounding in the statistical literature.<sup>8</sup> Figure 1 shows a visual representation of these contradictory cross-sectional and longitudinal effects. While moving from authoritarian countries to democracies is associated with lower emissions, democratization spells within the same country are accompanied by rising emissions.<sup>9</sup>

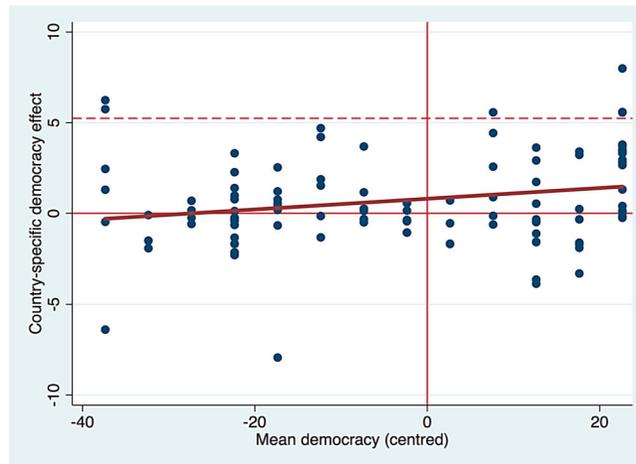
The discussion now moves onto ascertaining whether democratization causes emissions to rise in all countries. In other words, does democratization always inhibit mitigation, or does it have a desirable – emissions-reducing – effect on some countries and under certain conditions? Model three goes some way towards answering this question by allowing the effect of democratization to vary between countries. The first thing to report is that the fixed effect of democracy increases substantially from 1.79 in the RIM to 5.24 in the RCM, but ceases to be significant. Crucially, this does not suggest that democracy is no longer an important driver of emissions levels. On the contrary, the democracy random effect term,  $u_1$ , indicates that the effect that domestic fluctuations in democracy levels have on emissions levels varies substantially – by an average of 1654.38 points – between countries. This finding is highly significant at the 0.001 level, which demonstrates that democracy is an influential driver of emissions, but has different effects on different countries. The sheer magnitude of variation means that the fixed effect, which estimates the mean effect of democracy across all countries, is a poor indicator of the heterogeneous effects of democracy on emissions, thereby justifying the use of the random effects model. Crucially, the RCM suggests that, contrary to the previous models, it is wrong to generalize that democratization has a typical (positive or negative effect) on emissions levels across all countries. Strikingly, the country-year R-squared term shows that the RCM explains 46.65% of variation in emissions, which, alongside the LR test results, confirms that the model is a better fit to the data than the equivalent RIM and OLS.

Figure 2 plots the predicted country-specific (fixed plus random) effects of democratization (a one-point increase in a country's FH democracy score) as a function of the accumulated democratic stock of a country (a country's mean FH democracy score from 1990 to 2012). The dispersion of the country-level effects around the fixed effect coefficient across all countries (represented by the dashed horizontal line) illustrates that the fixed effect is a poor indicator of the influence of democratization on emissions. It also provides evidence of a mild positive relationship between the effect of democratization and prevailing level of democracy



**Figure 1.** Cluster-confounding in democracy effects

Note: Points represent country-years, dashed lines between-country effects and solid lines within-country effects.



**Figure 2.** Random country effects of democratization on emissions levels (excluding outliers).

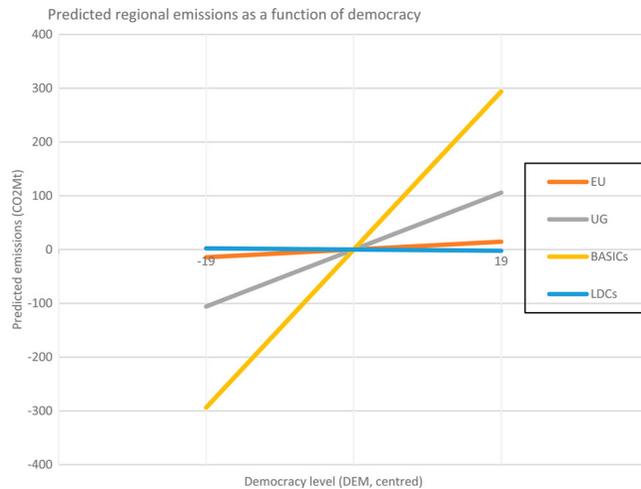
Note: Each point represents a country-specific effect.

within a country. In authoritarian countries (on the left side of the x-axis), the line of best fit falls below the y-axis, suggesting that democratization tends to have the desired effect of reducing emissions in these countries. This effect is more pronounced for countries that are located in the lower left quadrant, but does not hold for the countries in the top left quadrant, in which democratization is associated with higher emissions. The figure also suggests that, on average, after countries accumulate a certain level of democratic stock, further bouts of democratization start to become incompatible with mitigation as they have an emissions-boosting effect. This effect is especially strong for countries in the top right quadrant, which are both highly democratic and experience the largest increase in emissions with democratization. Advanced democracies in the lower right quadrant, however, do not fit this rule as increasing the level of democracy in these countries gives rise to lower emissions. On the figure, the critical point at which democratization switches from inhibiting to increasing emissions is where the line of best fit cuts the x-axis (approximately minus 27 points), the level of democratic institution and process that is present in Cameroon, Kenya, Mozambique and Seychelles.<sup>10</sup> On an international scale, this is only a modest level of democracy as it falls well below the world average, which corresponds to zero on the centred DEM variable.

Is it possible to infer something from these results about the emissions levels of the leading geopolitical alliances in the multilateral climate negotiations? [Figure 3](#) plots the mean posterior estimates of four such groups – namely: the UG, EU, BASICs and LDCs. The lines represent the predicted democratization–emissions relationship for four hypothetical countries that possess the mean democracy scores of each country grouping across plus and minus one standard deviation democracy (19 points). The angle and steepness of the line indicate the sign and magnitude of the effect respectively. Out of the four lines, BASIC has the steepest slope, suggesting that democratization has the strongest emissions-boosting effect in this group. The EU and UG also exhibit positive relationships, though not as pronounced as for BASIC. From these simulations, it is possible to infer that further bouts of democratization in most countries is likely to drive up emissions, thereby inhibiting mitigation. Yet, importantly, this does not apply to the LDCs; here, democratization has a desirable effect on emissions. The downward slope of the LDCs line, albeit only subtle, suggests that an increase in democratic levels in the poorest countries reduces emissions, thereby improving compatibility with mitigation in regions that are most vulnerable to climate change.

## Robustness tests

This section discusses the results of two tests that were conducted to evaluate the robustness of the above findings and extend the inferences about the relationship between democracy and emissions. First, the



**Figure 3.** Regional emissions as a function of democracy.

Note: The values of all other variables are set to zero, the grand mean across all observations on a centred scale, to isolate the effect of democracy on emissions. Random intercepts were omitted to aid visual comparison of regional random effects from the same intercept. When random intercept values are included, the predicted emissions levels fall within the normal range of expected values.

regressions from the last section were repeated using three alternative measures of democracy to determine whether the influence of democracy remains consistent when the seven-point FH index is replaced with different proxies. Second, the RIMs were implemented on three subsets of democratic countries (namely: proportional representation, majoritarian and mixed democracies) to determine whether the type of electoral system plays a role in shaping the effect of democracy on emissions.<sup>11</sup>

### **Test one: alternative democracy proxies**

There is much criticism surrounding the ability of conventional democracy indices such as FH to adequately capture what they claim to measure. While this is not the place for an in-depth discussion of such issues, definitional oversights (such as whether voting was extended to all races and genders) and precision issues are among the chief concerns.<sup>12</sup> One way of evaluating whether such issues infringe on the findings above is to repeat the regressions using alternative democracy proxies that are built on different, though related, definitional premises. Hence this robustness exercise uses data from the Polity II variable from the Polity IV database, the binary FH democracy index and V-Dem index to analyse whether the findings in the results section continue to uphold for alternative democracy proxies. While the FH and Polity II data comprise the most frequently used democracy metrics, the V-Dem index was recently developed to overcome many of the shortcomings of the conventional democracy indices (Teorell, Coppedge, Skaaning, & Lindberg, 2016). It also has the added advantage of disaggregating five components of democracy (namely: freedom of expression, association, share of population with suffrage, clean elections and elected officials), which could shed light on the mechanism through which democracy shapes emissions.<sup>13</sup> Table 4 shows the estimates for the alternative democracy proxies alongside the previous coefficients from the 7-point FH index for reference.

Perhaps the most striking thing to report is that, unlike in the 7-point FH model above, none of proxy coefficients undergo a sign change when moving from the OLS to the RIM model. Although this somewhat weakens the cluster-confounding hypothesis proposed above, closer inspection reveals that the underlying pattern is consistent: In most of the flat regressions, democracy has a strong significant inhibitory effect on emissions, yet the magnitude of this desirable effect significantly diminishes once the country-origin of emissions is accounted for. Thus, while the between and within country effects of democracy might not be as contradictory as depicted in Figure 1, the striking reduction in the coefficient sizes across the RIMs suggests that the inhibitory effect of democracy on emissions is stronger cross-sectionally than it is within the same country. Furthermore, the random effect term is

**Table 4.** Democracy estimates for different proxies.

| Proxy                             | Parameter          |                 |                  |                     |
|-----------------------------------|--------------------|-----------------|------------------|---------------------|
|                                   | OLS                | RIM             | RCM              | Random effect       |
| Freedom House (7-point)           | -8.48 (0.96)***    | 1.79 (0.65)**   | 416.56 (168.00)* | 1654.38 (248.51)*** |
| Freedom House (binary)            | -257.45 (32.09)*** | -9.70 (17.45)   | -9.70 (17.45)    | 0.00 (0.00)         |
| Polity IV                         | -25.24 (2.82)***   | -1.33 (1.67)    | -1.33 (1.67)     | 0.00 (0.00)         |
| V-Dem (aggregate)                 | -0.99 (0.43)*      | -0.54 (0.16)**  | -0.11 (0.47)     | 4.23 (0.41)***      |
| Freedom of expression             | -0.62 (0.42)       | -0.34 (0.17)    | -0.29 (0.45)     | 3.80 (0.31)***      |
| Freedom of association            | -1.40 (0.41)**     | -0.61 (0.17)*** | -0.20 (0.44)     | 3.68 (0.31)***      |
| Share of population with suffrage | -0.00 (0.00)       |                 | (indeterminate)  |                     |
| Clean elections                   | -1.52 (0.42)***    | -0.72 (0.19)*** | -0.46 (0.39)     | 2.95 (0.26)***      |
| Elected officials                 | -0.00 (0.00)       |                 | (indeterminate)  |                     |

Note: Single-level entries are ordinary least squares estimates and multilevel entries are maximum likelihood estimates with estimated standard errors in parentheses.

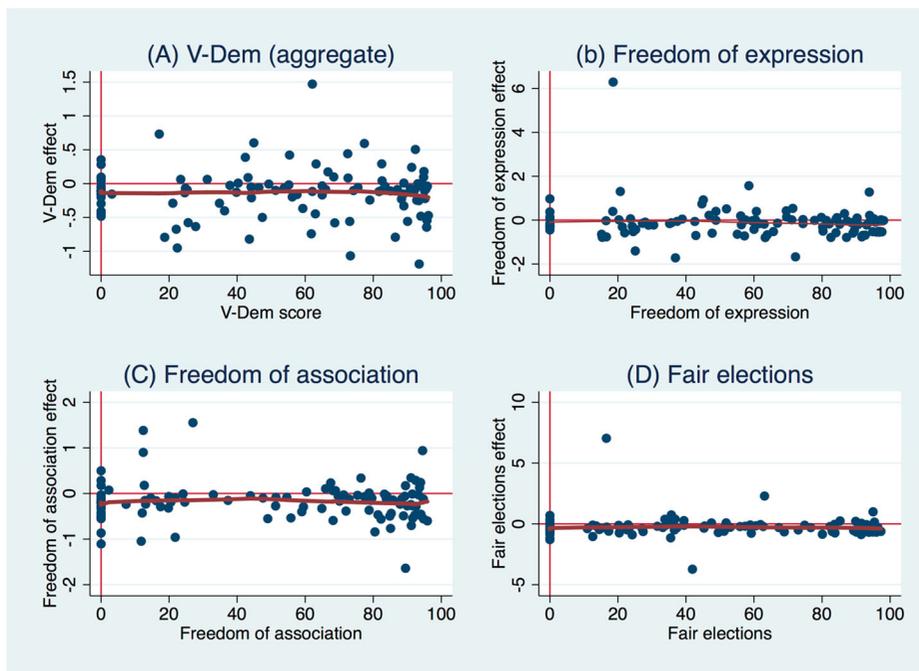
\*Significant at 5% ( $p < 0.05$ ).

\*\*Significant at 1% ( $p < 0.01$ ).

\*\*\* Significant at 0.01% ( $p < 0.001$ ).

significant at the 0.001 level in all of the RCMs except the binary model and polity IV models. Since binary measures of democracy do not capture nuances in the level of democracy, it is probable that the insignificant random effect term in the binary FH model is due to the measurement limitations of the proxy rather than the absence of heterogeneous effects. The insignificant random effect term in the continuous model, however, might stem from the emphasis that the polity IV measure places on freedoms and liberties as opposed to the other indicators of democracy. As discussed in the conclusion, this argument suggests that freedoms and liberties rather than other markers of democracy might be the underlying source of diverse country-specific effects on emissions.

Figure 4 plots the predicted country-specific (fixed plus random) effects of democratization on emissions as a function of a country's pre-existing level of democracy for each of the proxies that were found to have significant random effects. Trends are shown using nonparametric, locally weighted scatter plot smoothers (lowess plots),



**Figure 4.** Random country effects of democratization of emissions under different proxies (excluding outliers).

Note: Each point represents a country-specific effect.

**Table 5.** Democracy coefficients in different electoral systems.

| Proxy                             | Proportional representation | Majoritarian   | Mixed          |
|-----------------------------------|-----------------------------|----------------|----------------|
| Freedom House (7-point)           | 1.39 (0.34)***              | -0.76 (1.41)   | 6.34 (0.92)*** |
| Freedom House (binary)            | -24.43 (10.41)*             | -17.44 (33.99) | 10.37 (26.6)   |
| Polity IV                         | -0.23 (0.79)                | -3.17 (3.84)   | 8.40 (3.13)**  |
| V-Dem (aggregate)                 | 0.26 (0.10)*                | -0.21 (0.29)   | 0.11 (0.23)    |
| Freedom of expression             | 0.56 (0.12)***              | -0.10 (0.30)   | 0.54 (0.24)*   |
| Freedom of association            | 0.47 (0.10)***              | -0.36 (0.31)   | 0.53 (0.25)*   |
| Share of population with suffrage | indeterminate               | indeterminate  | 61.14 (85.14)  |
| Clean elections                   | 0.25 (0.10)*                | -0.14 (0.37)   | -0.16 (0.27)   |
| Elected officials                 | -0.00 (0.02)                | 0.00 (0.08)    | -0.01 (0.04)   |

Note: Entries are maximum likelihood estimates with estimated standard errors in parentheses.

\*Significant at 5% ( $p < 0.05$ ).

\*\*Significant at 1% ( $p < 0.01$ ).

\*\*\* Significant at 0.01% ( $p < 0.001$ ).

which are indicated by the thick lines. The relatively flat slopes of all the lowest lines suggest an indeterminate relationship between the effect of democratization on emissions and level of democratic stock that a country begins with. Thus, contrary to the first set of findings, this robustness test does not provide strong evidence that democratization switches from inhibiting to boosting emissions as the level of democracy (or its component parts) increases. Hence the second robustness exercise considers another potential source of random effects.

### Test two: electoral system

The second robustness exercise considers whether the type of electoral system in a democracy has a bearing on the effect that democratization has on emissions levels.<sup>14</sup> Fredriksson and Wollscheid (2007), for example, attribute the positive effect of democracy on environmental policy to proportional parliamentary systems. In contrast, they find that majoritarian democracies do not perform better than autocracies in environmental policy. Similarly, Fredriksson et al. (2010) and Harrison and Sundstrom (2010) argue that proportional parliamentary systems have a bias towards more stringent environmental policy than majoritarian systems. In contrast, Bohmelt et al. (2016) argue that majoritarian-presidential systems are more successful at environmental policy, apparently because of the increased influence they afford to environmental NGOs in policymaking.

This robustness test analyses the role of electoral systems in conditioning the effect of democracy on emissions by running (for each of the democracy proxies) the equivalent RIM<sup>15</sup> from above on proportional representation, majoritarian and mixed electoral systems subsets of democratic countries. Table 5 displays the estimated democracy coefficients.

The results point to striking differences in the effects of democratization across electoral systems. Estimates in all but two of the proxies (the binary FH variable and polity IV) suggest that an increase in democratic institution and process in proportional representation systems is significantly associated with higher emissions. In contrast, democratization appears to have a desirable inhibitory effect on emissions in majoritarian systems, although none of the estimates in this column are statistically significant.<sup>16</sup> Mixed democracies, which possess characteristics of both proportional representation and majoritarian systems, fair the worst as higher levels of democracy are associated with the largest increases in emissions. While these results are in accordance with Bohmelt et al.'s (2015) finding that environmental NGOs tend to be more influential in majoritarian-presidential systems than proportional parliamentary ones, the results should be interpreted with caution, particularly in light of the small sample sizes involved.

### Conclusion

The empirical analyses presented in this article provide strong evidence that democracy is an influential driver of emissions levels. Even when country-level clustering is accounted for, the democratic quality of domestic political regimes has a significant effect on emissions levels. For the most part, countries that possess stronger democratic attributes tend to exhibit lower emissions levels than relatively closed political regimes. However,

the results also indicate that this desirable effect is weaker – and sometimes even contradictory – within the same country than it is between different countries. Regardless of which democracy proxy one chooses, the inhibitory effect of bouts of democratization within the same country are significantly weaker than cross-sectional increases in the level of democracy.

What is perhaps more unexpected, however, is that the magnitude and direction of the effect of democratization varies significantly between countries, warranting the use of random effect modelling. One avenue of explanation explored by this article is that the democracy effect is a function of the level of accumulated democratic stock that a country begins with. While the results of the seven-point FH democracy index model indicated that bouts of democratization have the strongest inhibitory and, therefore, most desirable effects on closed political systems, these findings were not reflected in robustness tests. Repeating the same models with different democracy metrics revealed that the type of electoral system is a more viable source of heterogeneity in democratization effects: the results of four out of five of the continuous democracy models showed that increases in democratic institution and process tend to have a desirable, inhibitory effect on emissions in majoritarian-presidential systems. In stark contrast, democratization in proportional representation-parliamentary and hybrid democracies was associated with marked increases in emissions, suggesting incompatibility with mitigation. While these results cohere with existing findings that the environmental performance of majoritarian-presidential systems is better than that of proportional-parliamentary democracies (e.g. Bohmelt et al., 2015), the small sample sizes involved caution against deterministic conclusions. Instead, the findings point to a different kind of conclusion which has implications for future research: there is a clear need to devise better measures of the influence of pro and anti-climate actors such as environmental NGOs and high-carbon interests to help identify the specific dimensions of democracy that appear to play an important role in determining how political regimes influence national emissions levels.

The results of this article also speak to a broader methodological issue about the importance of selecting appropriate and multiple democracy metrics (Casper & Tufis, 2003; Coppedge et al., 2011; Teorell et al., 2016). While some of the results of the robustness tests were in accordance with the first set of findings (i.e. that cross-sectional increases in democracy have stronger inhibitory effect on emissions than democratization effects within the same country), they also indicate that the differences may not be as striking as the first seven-point FH model suggests. Hence the results of this article cohere with Casper and Tufis (2003) important finding that coefficients and signs can differ substantially even when using highly correlated democracy metrics. As discussed above, the striking differences between the seven-point FH index and other continuous democracy estimates are likely to stem from theoretical differences in the democracy proxies. Importantly, due to the emphasis that the FH index places on political rights and civil liberties, the index is often charged with being a better indicator of freedom rather than democracy (Hogstrom, 2013). To the extent that these claims are true, variation in the country-specific effects of democratization on emissions might be driven by the level of political freedoms in a country rather than the level of democratic stock.

What is the policy relevance of these findings? On the one hand, stronger democracies tend to exhibit lower emissions levels than weaker ones, suggesting compatibility with mitigation. On the other hand, the results also show that democratization spells within the same country do not always translate into lower emissions levels. Indeed, regardless of which (continuous) democracy metric one chooses, the democratization effect varies significantly between countries. As discussed above, the type of electoral system seems to play an important role in conditioning the effect of democratization. While it is not possible to infer from this article why this might be case, existing research suggests that majoritarian-presidential electoral systems might perform better because of the greater influence they afford to environmental NGOs (Bohmelt et al., 2015). If this is true, then these results suggest that the empowerment of environmental NGOs could prove to be a critical strategy in helping to ensure that the environmental impact of democratizing reforms, which are often pursued for non-environmental reasons, is positive.

## Notes

1. This article uses the term 'democratic stock' to refer to the (mean) average level of democratic institution and process that a country possesses over the time period under investigation (from 1990 to 2012).

2. Thanks to an anonymous reviewer for pointing this out.
3. Unlike most of the other groups (all except the BASIC states), the MIDCs is not a formal group in the negotiations, but rather, an analytical category that denotes the members of the G77 that are associated with *moderate* income levels falling between those of the LDCs and AOSIS (lowest income) and BASIC states (highest income).
4. Importantly, the country groupings do not overlap. Membership of these groups can be found in the technical [appendix](#).
5. In accordance with the environmental Kuznets curve literature, per capita GDP squared was initially included as an additional control to hold constant the effect of economic growth on emissions, but was omitted because it was not found to be statistically significant in any of the models analyzed in this article.
6. For a discussion of the theoretical reasons for this relationship, see, for example, Pellegrini and Gerlagh (2006), Wilson and Damania (2005) and Cole (2007).
7. Since FH democracy scores were multiplied by ten, the effect size is equal to ten times the DEM coefficient.
8. See Bartels (2008) for an excellent discussion on cluster-confounding.
9. There are also other important differences between the OLS and RIM estimates which indicate that some of the variables that were found to be significant drivers of emissions in the OLS are not robust to country-level clustering and/or exhibit contradictory between and within-country effects. Due to space restrictions, these differences are discussed in the technical [appendix](#).
10. This corresponds to a score of 4.3 on the FH democracy index.
11. As a third robustness test, a pooled mean group estimator was used to evaluate whether democratization exhibited similar short-term within country effects with a different model specification. Consistent with the results above, the model found evidence of significant variation in democratization effects between countries, although they did not add to the interpretation of the results are therefore not reported.
12. For an in-depth overview of these issues, see Coppedge et al. (2011).
13. Thanks to an anonymous reviewer for this suggestion.
14. Thanks to two anonymous reviewers for this suggestion.
15. The RIM was preferred to the RCM as the significant random effect terms from the previous models provide strong evidence that the fixed effect in the RCM is a poor indicator of the typical democracy effect when coefficients are allowed to vary between countries.
16. This is likely due to the small size of the majoritarian country sample.
17. The LR value is the probability of obtaining the observed values (emissions data for the sample) if that model were true.
18. All multilevel models described in this article were fitted using Stata's `xtmixed` command.

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