

## How does a democratic government with limited intervention affect environmental quality? Fresh evidence with international panel data



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### ABSTRACT

This paper examines the effect of democratic countries which encourage economic freedom on the environment, measured by Carbon Dioxide (CO<sub>2</sub>) emission. For the empirical analysis, an annual panel data sample consisting of 179 countries from 1990 to 2018 is collected. Applying the Ordinary Least Squares and Two-Step Generalized Method of Moments estimation techniques, we find that the environmental quality is enhanced with a higher degree of democracy and economic freedom. The results firmly hold for high and middle-income countries when the sample is decomposed across income levels.

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### 1. Introduction

Environmental concerns are long debated in the literature. Democracy and economic freedom are often considered to be potential variables to improve or degrade the environment (improvement in environment implies a reduction in the levels of CO<sub>2</sub> emissions whereas higher levels of CO<sub>2</sub> emissions mean environmental degradation). There are arguments establishing that the environment is positively and negatively affected by both democracy and economic freedom.

There are potential determinants due to which democracy is found to improve environmental standards by decreasing CO<sub>2</sub> emissions. The existing literature catalogs accountability, right to information, civil society and international competition (Payne, 1995), political rights and freedom of information (Schultz and Crockett 1990), inclusion of society in redistribution (Congleton, 1992), free and fair elections (Kotov and Nikitina, 1995), enforcement of environmental regulations and agreements (Weiss and Jacobson, 1999) as factors which lead to enhance environmental standards. On the contrary, sluggishness of democratic governments (Midlarsky, 1998), the scope of government (Paehlke, 1996), freedom and

access to human rights such as population growth rate (Heilbroner, 1991), the influence of capitalist class on democratic government (Dryzek, 1987), the pressure of higher production to attract votes (Desai, 1998) and pressure to enhance foreign direct investment (Romuald, 2011) are enlisted as potential causes why democracies may lead to degrading environment through compromising on higher levels of CO<sub>2</sub> emission.

Apart from democracy, economic freedom is also cited in the literature as a prominent determinant of the environment. For example, the sense of corporate social responsibility (Berge, 1994; Wood and Herzog, 2014), property rights (Panayotou, 1997) are classified as potential determinants of the environment. Furthermore, the environment is also affected through the size effect, the efficiency effect, the trade regulation effect, and the stability effect.

As we know that the effect of democracy on the environment as well as the effect of economic freedom on the environment is separately analyzed in the previous literature. Keeping this in view, we analyze how democratic countries affect the environment while encouraging economic freedom. The main contribution of this paper is to apply the interaction effect between democracy levels and economic freedom and then analyze how this interaction term relates to the environment. For empirical analysis, the data sample is collected for 179 countries from 1990-2018 and Ordinary Least Squares and Two-Step Generalized Method of Moments estimation techniques are used. The findings suggest that the democratic countries which promote economic freedom improve environmental quality (reduce CO<sub>2</sub> emission level).

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In addition to this, the sample is decomposed across income levels. The findings are substantially confirmed across high and middle-income countries.

Section 2 and section 3 review literature relating to the effect of democracy and economic freedom on the environment respectively. Section 4 discusses data whereas section 5 reports empirical analysis. The last section concludes.

## 2. Democracy and environment

This section discusses how changes in democracy may potentially affect the environment measured by CO<sub>2</sub> emissions. Quite interestingly, the literature establishes both positive and negative effects of democracy on the environment.

Payne (1995) discussed four main reasons why democratic governments are able to improve environmental quality. The study mentions that accountability, information, civil society, and international competition are major attributes of democracies that enforce governments to improve the environment. Democratic governments are more accountable to the public and, hence, they work on improving environmental standards to attract more voters. Similarly, press freedom is a major attribute of any democratic regime. Because of the freedom of the press, the public has better access to information regarding social issues and problems such as environmental issues. Consequently, this helps environmentalists in organizing mass public movements against environmental hazards the societies suffer through. Further, the pressure on governments is often exerted through massive public awareness campaigns. Lastly, democratic countries are more efficient in bringing all stakeholders together within and across countries to fight against the common goal—environmental concerns. As a result, they are likely to yield better results in improving environmental quality.

Democracy improves environmental standards through strengthening and empowering the public. According to literature, political rights and freedom of information are supported more and protected better by democratic regimes. Owing to strengthened political rights and efficient flow of information across society, the cause of interest groups aspiring for public consciousness and better legislation on environmental issues is considerably promoted. As a result, these interest groups successfully grab public attention and motivate them to work for improving environmental standards. On the other hand, since autocratic regimes put controls and hinder the flow of information, the public stays uninformed about environmental degradation. Furthermore, autocrats prefer autonomous decisions benefitting the elite at the cost of the majority (Schultz and Crockett, 1990).

Drawing a comparison between democracy and dictatorships is notable. Democracy is a participatory political system whereas dictatorships are formed by a few powerful elites. Congleton (1992) found that the elite are not pro-environment.

The larger share of national income and industry is owned by the elite class under dictatorial regimes. Hence, the legislation against industries that emit pollution bears negative consequences for the very elite. Given this, the dictatorial regimes lead to harm environmental quality through overproduction as it may result in higher profits.

The likelihood to hold free and fair elections is higher in democracies (Kotov and Nikitina, 1995). Consequently, the environmentalists in democratic regimes stand a fair chance to constitute governments and improve the environment as opposed to autocratic regimes.

Since rule of law is an attribute of democracy, it is found that the quality of the environment is often improved in societies where rule of law dominates. It is found that the environmental quality enhances under democratic regimes because they abide by the rules and regulations and honor agreements signed for improving environmental standards (Weiss and Jacobson, 1999).

The probability of famine occurrence in democracies is lesser than in autocracies. The societies suffering through famine are lesser inclined to prioritize long-run environmental concerns and rather are more concerned for issues at hand. As a consequence, the environmental quality degrades in such societies (Sen, 1994).

Along these lines, countries that have sustained a democratic system for a considerable time period are found to improve environmental quality. However, the environment quality is unaffected in countries that could sustain the democratic process for a shorter span of time (Gallagher and Thacker, 2008).

On the other hand, democracy may harm the environment. For example, it is argued that the wheels of democratic governments turn rather slowly. Democracy follows a certain/due process and is bound to take all the stakeholders on board. The public policy regarding the environment often falls victim to government inertia. Since there are competing forces and governments in power desire to keep their constituencies intact, environmental concerns are brushed aside by democratic countries (Midlarsky, 1998).

It is also established that democratic governments can't tackle environmental problems as effectively as possible since the authority of democratic government is constrained within geographic boundaries whereas the environment is a global public good (Paehlke, 1996).

The inability of democratic governments to improve environmental standards is also caused by their inability to effectively control the population. The population also poses threats to the environment. In accordance with the literature, the autocratic government can stop the population growth rate more effectively because their decision-making is centralized. However, people enjoy more rights in democracies which makes it difficult for governments to put controls over population growth rates. As a result, the rising global population growth

rate gives rise to threats ensuing from environmental degradation (Heilbroner, 1991).

Another factor responsible for the inefficacy of democratic government to take care of the environment is a capitalist democracy. Capitalist economies thrive under democratic regimes. Enforcing laws against the pollution-emitting industry is difficult under democracies favoring the free market because such regulations hurt the interests of elite investors. This lack of enforcement by democratic government leads to environmental degradation (Dryzek, 1987).

In addition, in the quest for attaining higher economic growth (Desai, 1998) and foreign direct investment (Romuald, 2011) the democratic regimes lead to a degrading environment. As per the argument, democracies lead to higher economic development. To attain higher economic development, economies produce a higher quantity of goods and services which results in a higher level of pollution affecting the environment adversely. Similarly, democratic institutions adversely affect the environment though indirectly. In an effort to attract foreign direct investment and lower-income inequality, the democratic regimes compromise on the environment.

### 3. Economic freedom and environment

The debate on economic freedom is not new. There are both proponents as well as opponents of economic freedom. Though economic freedom is often discussed for its multi-dimensional impact, environmental quality is one of its major concerns.

Incentives and optimal use of resources are core reasons why proponents of economic freedom advocate it. There are simplified hypotheses about the relationship between economic freedom and the environment. For example, environmental quality is affected through the government size effect, the efficiency effect, the trade regulation effect, and the stability effect. These four effects are attributes of economic freedom.

**Government Size Effect:** How changes in government size affect the environmental quality is examined through the government size effect. It depends on the composition of government expenditures as a fraction of GDP. An inverted U-shaped relationship between government size and environmental quality measured by CO<sub>2</sub> emissions is found. According to this study, CO<sub>2</sub> emissions increase initially at a smaller government size. However, later, at larger government size the CO<sub>2</sub> emissions are found to decrease (Carlsson and Lundström, 2001).

**The Efficiency Effect:** According to literature the efficient and competitive markets are formed in free economies. Negative externalities to society in the form of pollution emissions are better addressed in free economies. Furthermore, free economic systems are more capable of catering to consumer preferences relating to environmental concerns.

**Trade Regulation Effect:** Trade regulations through tariffs reduce economic freedom. However, in a competitive world, more trade encourages industries to compete with each other and utilize limited resources more efficiently such as environmental resources. Since the environment is a public good and a global phenomenon, it's important to use this resource effectively and efficiently.

**The Stability Effect:** Macroeconomic stability is crucial for environmental stability. In the long run, higher economic stability leads to improve environmental quality. Another perspective that it can be analyzed through is the enforcement of property rights. According to a study conducted by Panayotou (1997), if the rights of farmers are ensured and honored, they will invest more in soil conservation. Consequently, the long-term investments will ensure the optimal use of land as a resource.

Environment quality is also found to be upgraded with more economic freedom. It is maintained that economic freedom is positively correlated with environmental quality because it promotes market economies. Owing to competition and corporate social responsibility, these markets encourage the production of goods using environment-friendly technology (Wood and Herzog, 2014; Berge, 1994).

### 4. Data

Annual panel data set from 1990 to 2018 covering 179 countries is collected. Data for democracy, measured by Polity II, is collected through the Polity IV database. It ranges from -10 to +10 where -10 describes absolute dictatorship and +10 refers to perfect democracy. On average, the mediocre level of democracy prevails in the selected sample is 4.38 as reported by mean value through Table 1. However, the standard deviation, 5.82, is suggestive of the fact that the inclination of countries whether to follow democracy or dictatorship considerably varies.

Data for economic freedom is collected through the Index of Economic Freedom from Heritage Foundation. This variable is calculated from property rights, judicial effectiveness, trade freedom, investment freedom, monetary freedom, government expenditures (%GDP), fiscal freedom, labor freedom, financial freedom, government integrity, tax burden, and fiscal health. It ranges between 0-100 where 0 means no freedom and 100 means complete economic freedom. The majority of the countries included in the sample enjoy economic freedom as indicated by the mean value, 59.80. On the contrary, the standard deviation, 10.30, shows that some countries enjoy more freedom in economic matters as compared to other countries where economic freedom is curtailed.

World Development Indicators (WDI) database is used to collect data for CO<sub>2</sub> emission (kg per PPP \$ of GDP) measuring environmental quality. There is a considerable number of countries where CO<sub>2</sub> emissions are very high as suggested by the mean

which is 0.33. However, the standard deviation, 0.27, environmental standards. shows disparity among countries in terms of

**Table 1:** Summary statistics

Variables	Observations	Mean	Standard Deviation	Minimum	Maximum
CO <sub>2</sub> Emission	1921	.3323783	.2738432	.0204166	2.367653
Democracy	1948	4.381473	5.82493	-10	10
Economic Freedom	1895	59.80526	10.30339	21.4	83.1
GDP Growth	1845	3.993304	5.77581	-62.07592	123.1396
Trade	2653	71.96623	35.88654	15.63559	221.158
Population	2727	1.477257	1.276239	-3.107229	7.917892
Foreign Direct Investment	2183	30.90123	13.94567	2.328963	47.72783
Direct Taxes	2729	26.45403	14.31954	-1.34838	79.53935
Indirect Taxes	2692	31.6752	12.60677	.1239893	77.68766
Dependency Ratio	2646	63.16929	18.97459	28.35954	113.8576
Income Inequality	1799	44.38815	6.349035	29.35948	62.85039

As control variables, GDP growth following (Selden and Song, 1994; Le et al., 2019) to measure Environmental Kuznets Curve, trade as a share of GDP following (Antweiler et al., 2001), population growth rate following (Abdouli et al., 2018; Sherbinin et al., 2007), foreign direct investment (FDI) following (List and Co 2000), taxes on income, profit and capital gains (direct taxes) following (Lombardini-Riipinen, 2005), taxes on goods and services (indirect taxes) following (Lombardini-Riipinen, 2005), dependency ratio following (Tuncer et al., 2005) and inequality following (Galbraith and Kum, 2005; Hailemariam et al., 2020) are included. The source of data set for all control variables is World Development Indicators except inequality. Data for inequality is gathered from the University of Texas Inequality Project's estimate of household income inequality.

**5. Empirical analysis**

In this section the impact of how democratic countries encouraging economic freedom affect CO<sub>2</sub> emission. To start with the basic estimation technique, the Ordinary Least Squares (OLS) is applied. Column 1 of Table 2 reports coefficient estimates of democracy and CO<sub>2</sub> emissions as main regressors including all control variables. The sign of the estimated coefficient for democracy is positive and statistically significant at a 5% level. The positive correlation between democracy and CO<sub>2</sub> emission implies that the environment is damaged as societies democratize. It may be inferred that democracies are influenced by voters and certain business groups. Before proposing any environmental regulations and implementing over them, democratic governments often take all stakeholders on board. This requires time and delays policymaking. Meanwhile, the environmental issues aggravate and become even worse. Another rationale proposed for democracies leading to a degraded environment is the limited scope of democracy compared to the environment. The decision-making of democratic government is confined to geographical boundaries whereas the environment is a global public good. Consequently, the environmental concerns can be addressed only if leaders from across.

The world unites together to fight this menace. Since recognition, operational and administrative lags are involved in improving the quality of the environment, these lags affect the environment adversely. Similarly, another potential rationale for the positive correlation between democracy and CO<sub>2</sub> emission is that the democratic governments are accountable to the public. The immediate priority of the public is economic growth which is achieved with the production of more goods and services. With more production of goods and services the environment degrades. The finding confirms previous studies such as Midlarsky (1998), Paehlke (1996), Heilbroner (1991), Dryzek (1987), Desai (1998), and Romuald (2011).

Regarding the discussion on control variables included in the specifications, the signs of the coefficient estimate of GDP growth are positive and statistically significant. It implies that the environment degrades with higher economic growth. Similarly, the estimated coefficients for direct taxes, indirect taxes, and dependency ratio are positive and statistically significant. A rise in direct taxes, indirect taxes, dependency ratio, and income inequality lead to affect environmental standards negatively (CO<sub>2</sub> emission positively). Other control variables are not statistically significant.

Economic freedom and CO<sub>2</sub> emission is the main regressors in column 2. The coefficient estimate for economic freedom is negative and statistically significant at a 5% level. With a rise in economic freedom, the level of CO<sub>2</sub> emission reduces. The results are consistent with previous literature such as Wood and Herzog (2014) and Berge (1994). Economic freedom encourages competition and efficient allocation of environmental resources which leads to improving environmental quality. Along these lines, economic freedom ensures property rights and establishes an incentive system. Consequently, the landowners safeguard their lands, and industrialists market environment-friendly goods and services. The overall impact of economic freedom through competition, regulation, and incentive system leads people to protect the environment by emitting a lower quantity of CO<sub>2</sub> emissions.

Given the contrary effects of democracy and economic freedom on CO<sub>2</sub> emission, it is logical to

assess the impact of democratic countries which encourage economic freedom on  $CO_2$  emission. Borrowing from the literature of Econometrics, we apply the interaction between democracy and

economic freedom. The sign of the estimated coefficient is found to be positive and statistically significant at a 5% level when democracy interacts with economic freedom in column 3.

**Table 2:** Basic estimation results

	(1)	(2)	(3)	(4)	(5)	(6)
				High Income	Middle Income	Low Income
Democracy (Dem)	.0392 (.0189)**		.0326 (.0177)*	.0351 (.0203)*	.0313 (.0456)	.0210 (.0207)
Economic Freedom (EF)		-.0250 (.0119)**	-.0193 (.0174)	-.0202 (.0113)*	-.0179 (.0287)	-.0140 (.0167)
Dem*EF			-.0048 (.0021)**	-.0050 (.0023)**	-.0044 (.0019)**	-.0035 (.0043)
GDP Growth	.1314 (.0593)**	.1297 (.0578)**	.0961 (.0443)**	.0967 (.0463)**	.0876 (.0416)**	.0692 (.0323)**
Trade	-.0217 (.0159)	-.0229 (.0179)	-.0175 (.0083)**	-.0188 (.0149)	-.0162 (.0114)	-.0127 (.0089)
Population	-.0566 (.0302)	-.0608 (.0325)	-.0468 (.0233)**	-.0491 (.0262)	-.0435 (.0232)	-.0341 (.0182)
Investment	-.0343 (.0997)	-.0327 (.1063)	-.0257 (.0836)	-.0370 (.0657)	-.0240 (.0748)	-.0191 (.0672)
Direct Taxes	.4767 (.2917)*	.5122 (.3134)*	.3940 (.2410)*	.4137 (.2530)*	.3665 (.2241)*	.2876 (.1759)*
Indirect Taxes	.5045 (.2480)**	.5421 (.2665)**	.417 (.205)**	.4378 (.2152)**	.3878 (.1906)**	.3044 (.1496)**
Dependency Ratio	.0983 (.0485)**	.1056 (.0521)**	.0813 (.0401)**	.0853 (.0421)**	.0756 (.0372)**	.0593 (.0292)**
Income Inequality	.0231 (.0085)**	.0248 (.0092)**	.0191 (.0091)**	.0200 (.0094)**	.0177 (.0086)**	.0139 (.0061)**
Fixed Effects	No	No	No	No	No	No
Countries	179	179	179	54	92	33
Observations	1991	1991	1991	856	948	187
R-Square	.87	.85	.92	.90	.88	.89

Notes: Table 2 contains results using OLS regression for  $CO_2$  emission (dependent variable) and democracy and economic freedom (main variables) as regressors. From columns 3 and onward the interaction between democracy and economic freedom is applied as discussed in the text. The control variables included are GDP growth per capita, Trade (%GDP) Ln (Population), Investment (foreign direct), Indirect taxes (% Revenue), Direct Taxes (% Revenue), Dependency Ratio, and Income Inequality. The sample is further decomposed for high-income (column 4), middle income (column 5), and low-income countries (column 6). \*, \*\*, \*\*\* report statistical significance at 10%, 5% and 1% level

The results imply that those democracies which encourage economic freedom lead to a decrease  $CO_2$  emission. The reduction in  $CO_2$  emission improves environmental quality. The possible rationale is that the democratic governments which allow more property rights, regulate efficiently, enjoy higher integrity, manage fiscal and monetary matters effectively, allow trade, labor, investment, and financial freedom, maintain judicial effectiveness, and encourage competition are in a better position to preserve the environment. Table 3 shows further estimation results.

Besides a broad analysis of 179 countries, the data sample is disintegrated for high, middle (upper and lower middle), and low-income countries according to country classifications by World Economic Situation and Prospects to infer more precise findings. The findings for high and middle-income countries are consistent with that of a whole sample consisting of 179 countries. For countries falling under a low-income category, nonetheless, the results are not statistically significant. A possible rationale for this is that the countries classified as high and middle-income countries substantially lead in  $CO_2$  emission.

Given that the panel data is usually confronted by time-invariant and country-specific factors, the results are also offered to apply time and country fixed effects through Table 3. Quite interestingly, the results reconciled with the results of Table 1.

Until now the empirical analysis is offered by applying the Ordinary Least Squares (OLS) estimation technique. This estimation technique is a good starting point for empirical analysis of the panel data set. However, there is a pertinent concern that needs to be dealt with properly to improve the reliability of results. As indicated by the literature, the explanatory variables may be endogenous to a dependent variable. GDP growth, trade as a share of GDP, foreign direct investment (FDI), direct taxes (taxes on income, profit, and capital gains) and indirect taxes (taxes on goods and services) may both cause and be affected by  $CO_2$  emission. For example, Galdeano-Gómez (2008) found that environmental policies have a positive effect on economic performance. To deal with the endogeneity issue, this paper also applies Two-Step Generalized Method of Movement (GMM) estimation.

There are some benefits of applying Two-Step GMM estimation. The foremost benefit of Two-Step GMM estimation is to take care of possible endogeneity issues between explanatory and dependent variables. Since the data set is a panel, there is a possibility that the model does not include all variables which may potentially affect the environment. In the literature, this problem is defined as omitted variable bias. Furthermore, the model may also confront unobserved panel heterogeneity and measurement errors. The Two-Step GMM is a better estimator in presence of

endogeneity, omitted variable bias, unobserved panel heterogeneity, and measurement errors.

Consequently, this study presents further empirical analysis applying the Two-Step GMM estimator.

**Table 3:** Further estimation results

	(1)	(2)	(3)	(4)	(5)	(6)
				High Income	Middle Income	Low Income
Democracy (Dem)	.0436 (.0216)**		.311 (.0248)	.0282 (.0236)	.0244 (.0316)	.0104 (.0049)
Economic Freedom (EF)		-.0433 (.0202)**	-.0229 (.0212)	-.0211 (.0349)	-.0187 (.0268)	-.0157 (.0247)
DemEF			-.0132 (.0058)**	-.0147 (.0067)**	-.0221 (.0105)**	-.0314 (.0814)
GDP Growth	.4880 (.2169)**	.1113 (.0563)**	.0627 (.0285)**	.0571 (.0258)**	.0429 (.0213)**	.3975 (.1631)**
Trade	-.1286 (.0930)	-.0311 (.0148)**	-.0127 (.0072)*	-.0191 (.0143)	-.0089 (.0096)	-.0012 (.0246)
Population	-.8998 (.4266)**	-.0567 (.0602)	-.0583 (.0267)**	-.0290 (.0234)	-.0253 (.0173)	-.1340 (.0474)***
Investment	-.0364 (.0979)	-.0389 (.0798)	-.0176 (.0749)	-.0243 (.0977)	-.0129 (.0576)	-.0158 (.0263)
Direct Taxes	-.4995 (.2666)*	.4763 (.2911)*	.3439 (.1612)**	-.2775 (.1394)**	-.1495 (.1078)*	-.1779 (.2721)
Indirect Taxes	.4640 (.2382)**	.6041 (.2676)**	.3993 (.1973)**	.2508 (.1113)**	.1960 (.0924)**	.1098 (.0823)
Dependency Ratio	.0265 (.0126)**	.0972 (.0481)**	.5144 (.1468)***	.0569 (.0271)**	.0870 (.0382)**	.0223 (.0108)**
Income Inequality	.0403 (.0195)**	.0270 (.0085)***	.0212 (.0114)*	.0210 (.0101)**	.0275 (.0129)**	.0517 (.0241)**
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Countries	179	179	179	54	92	33
Observations	1991	1991	1991	856	948	187
R-Square	.88	.85	.91	.93	.95	.90

Notes: Table 3 contains results using OLS regression for CO<sub>2</sub> emission (dependent variable) and democracy and economic freedom (main variables) as regressors. From columns 3 and onward the interaction between democracy and economic freedom is applied as discussed in the text. The control variables included are GDP growth per capita, Trade (%GDP) Ln (Population), Investment (foreign direct), Indirect taxes (% Revenue), Direct Taxes (% Revenue), Dependency Ratio, and Income Inequality. The sample is further decomposed for high-income (column 4), middle-income (column 5), and low-income countries (column 6). Time and country fixed effects are applied throughout the table along with clustering the standard errors by country. \*\*, \*\*\* report statistical significance at 10%, 5% and 1% level

Table 4 reports specifications applying the Two-Step GMM estimator. The democratic countries which enhance economic freedom are found to improve environmental quality as a consequence of

a reduction in CO<sub>2</sub> emission. The results for the whole and decomposed samples are more reliable as the statistical significance of coefficient estimates enhances to a 1% level.

**Table 4:** Further estimation results

	(1)	(2)	(3)	(4)	(5)	(6)
				High Income	Middle Income	Low Income
Democracy (Dem)	.0376 (.0135)***		.0283 (.0131)**	.0198 (.0092)**	.0174 (.0081)**	.0131 (.0091)
Economic Freedom (EF)		-.0277 (.0122)**	-.0173 (.0076)**	-.0121 (.0053)**	-.0106 (.0046)**	-.0080 (.0025)***
Dem*EF			-.0043 (.0011)***	-.0030 (.0008)***	-.0026 (.0007)***	-.0019 (.0048)
GDP Growth	.1098 (.0525)**	.1325 (.0634)**	.0826 (.0395)**	.0579 (.0277)**	.0507 (.0243)**	.0383 (.0273)
Trade	-.0208 (.0112)*	-.0251 (.0176)	-.0243 (.0110)**	-.0164 (.0077)**	-.0096 (.0067)	-.0072 (.0051)
Population	-.0558 (.0298)*	-.0673 (.0359)	-.0429 (.0214)**	-.0294 (.0157)	-.0258 (.0137)	-.0194 (.0104)
Investment	-.0295 (.0985)	-.0356 (.1188)	-.0222 (.0103)**	-.1565 (.0519)***	-.0136 (.0455)	-.0103 (.0343)
Direct Taxes	.4698 (.2874)*	.5668 (.3467)*	.3537 (.1763)**	-.2480 (.1517)*	-.2172 (.1328)*	-.1639 (.1002)*
Indirect Taxes	.4973 (.2444)**	.5999 (.2949)**	.3743 (.1840)**	.2624 (.1290)**	.2299 (.1130)**	.1734 (.0852)**
Dependency Ratio	.0969 (.0578)*	.1169 (.0576)*8	.0729 (.0360)**	.0511 (.0252)**	.0448 (.0221)**	.0338 (.3566)
Income Inequality	.0227 (.0384)	.0274 (.0102)**	.0171 (.0063)**	.0120 (.0044)**	.0105 (.0039)**	.0079 (.4229)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Countries	179	179	179	54	92	33
Observations	1991	1991	1991	856	948	187
R-Square	.86	.88	.91	.87	.89	.84

Notes: Table 4 contains results using Two-Step GMM regression for CO<sub>2</sub> emission (dependent variable) and democracy and economic freedom (main variables) as regressors. From columns 3 and onward the interaction between democracy and economic freedom is applied as discussed in the text. The control variables included are GDP growth per capita, Trade (%GDP) Ln (Population), Investment (foreign direct), Indirect taxes (% Revenue), Direct Taxes (% Revenue), Dependency Ratio, and Income Inequality. The sample is further decomposed for high-income (column 4), middle income (column 5), and low-income countries (column 6). Time and country fixed effects are applied throughout the table along with clustering the standard errors by country. \*\*, \*\*\* report statistical significance at 10%, 5% and 1% level

## 6. Conclusion

This paper assesses how democracies encouraging economic freedom affect  $CO_2$  emission. The democratic countries with a higher degree of economic freedom are found to reduce the level of  $CO_2$  emission leading to improve environmental quality. The results substantially hold particularly across high and middle-income countries. The literature could benefit from a consistent and unique measure of the environment which is a limitation of this study.

From a policy perspective, this paper underscores the complexity of a society. Democracy in isolation is not effective in dealing with environmental degradation. Rather, the carbon dioxide emission level may rise and adversely affect the environment under democratic regimes if the government's intervention in economic affairs is considerable. Thus, to improve environmental quality, the governments while promoting democracy should also encourage economic freedom.

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## Compliance with ethical standards

## Conflict of interest

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