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Article

The impact of governance and economic factors on Biocracy in the committed countries in COP28

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Abstract: Biocracy refers to a system of governance and decision-making that prioritizes the well-being and health of living systems, including ecosystems, species, and human communities. Biocracy promotes holistic, participatory, and adaptive management, integrating science, traditional knowledge, and collective decision-making. The goal is to cultivate a mutually enriching relationship between humans and the natural world. As a result, all human actions have an impact on Biocracy. This study covers annual data from 2010 to 2022 for a group of member countries of the COP28 with the percentage of emissions reduction needed to meet the 1.5-degree Celsius target by 2030 among current top emitters and employs the tobit panel model with a limited dependent variable (LDV). The primary economic variables that substantially influence Biocracy are GDP growth, foreign investment, inflation rate, employment, trade-related variables (exports and imports), and governance. The results indicate that the governance index and imports variable have the most significant positive effect on Biocracy, and the elasticity of governance has the largest impact on Biocracy among all the variables studied. The study's objective is to identify strategies to enhance Biocracy without hindering economic growth, with an emphasis on the role of good governance.

Keywords: Biocracy; governance; tobit panel model; COP 28
JEL Classification: C21; F30; F43; G10

1. Introduction

When discussing the Earth's natural system on a global scale, it is crucial to recognize that a single decision made with a timescale of millions of years, involving interactions with various factors and distributing tasks, will directly impact this natural system. The consequences of such decisions, whether international or regional, will be profound and long-lasting. To address this issue and engage in meaningful dialogue, we must utilize modern definitions, such as Biocracy, climate change, and their implications, and consider the potential consequences of ignoring these matters.

The first question raised is what is Biocracy?

The term Biocracy refers to a form of governance that prioritizes the well-being of all living beings, distinguishing it from democracy, which primarily serves human interests. In a Biocratic system, representatives would make decisions on behalf of non-human life, using proxies such as biodiversity and ecosystem health to gauge the best interests of the natural world, similar to how representative democracy operates on behalf of human citizens.

If we consider "Biocracy" in the context of respecting the environment, it could potentially refer to a system of governance or decision-making that prioritizes and values ecological sustainability and the well-being of ecosystems [1]. It may involve policies and practices that promote conservation, biodiversity, renewable resources,

and a harmonious relationship with the natural world [2].

Also, if we define "Biocracy" as the mix of governance and the environment, it could refer to a system of governance that integrates environmental considerations and sustainability principles into decision-making processes [3]. In a Biocratic system, environmental concerns and the well-being of ecosystems would be given significant weight and consideration when making policy choices and implementing regulations [4]. Therefore, the role of governance in Biocracy is key and important.

A Biocratic approach to governance would involve adopting policies that prioritize environmental protection, conservation, and sustainable resource management. It would aim to strike a balance between economic development and environmental sustainability, ensuring that the long-term health of the environment is taken into account when making decisions that may impact it [5].

While "Biocracy" may not be a widely used term, the concept of integrating environmental considerations into governance is gaining importance globally as societies recognize the need for sustainable development and ecological stewardship. Governments and organizations around the world are increasingly incorporating environmental concerns into their decision-making processes to address pressing issues such as climate change, biodiversity loss, and pollution [6].

It's worth noting that there are various approaches to environmental governance, and specific strategies and practices may differ depending on the country, region, or organization involved. The ultimate goal is to achieve a balance between human activities and the preservation of the natural environment for the benefit of current and future generations [7].

Since the environment is the number one issue in the world in the 21st century, but some politicians and social activists in America and Europe, with the start of environmental activists' activities around the world in the late 20th century, intended to confront this movement. They had no inclination to accept this reality and surrender to it, and the main reason for this was their development-oriented and consumerist worldview that prioritized economic growth over nature [8]. These politicians have always tried to accuse environmental activists, especially young people, of extremism, to keep them in a position of weakness and defense, and to prevent them from shaping public discourse around their agenda. However, with the start of the 21st century, the frequency and intensity of warnings from environmental scientists and climate experts to developed countries increased, and this led to a surge in global environmental activism [9]. According to the firm belief of bioconservatives, democracy is powerless to choose the right path for humanity's future because the laws that democracy seeks to impose on people are often in conflict with the laws governing nature [10–14]. Biocracy is a governance concept that transcends traditional democracy, promoting a holistic system where all living beings—humans, plants, animals, and others—possess equal opportunities and inherent rights to flourish and sustain their existence. The escalating climate crisis has sparked a contentious debate between two opposing perspectives. Proponents of bioconservatism argue that anthropocentric systems, such as democracy, are primarily responsible for this predicament [15]. In contrast, democracy advocates contend that mitigating climate threats poses an insurmountable challenge.

With the advancement of societies and the competition among nations to increase

domestic production and improve economic factors such as trade and foreign direct investment, the climate change threat has become a historical confrontation between humanity and nature. As shown in **Figure 1**, the top five countries with the highest levels of CO_2 emissions are China, America, India, Japan, and Germany [16].

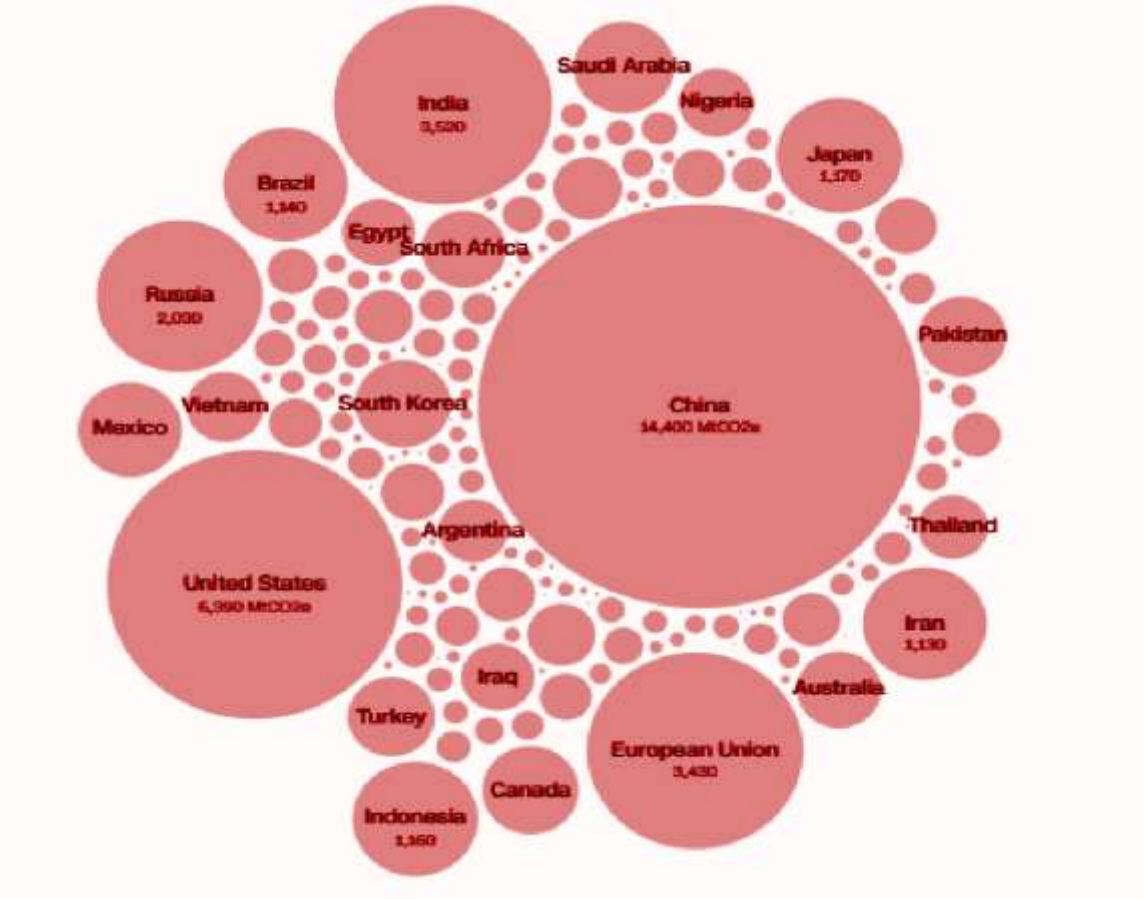

Figure 1. Total greenhouse gas emissions in 2022.
Sources: Climate Action Tracker, Gütschow and Pflüger [17].

According to **Figure 1**, the world pumped out around 50 billion metric tons of planet-heating gases in 2022. China was the largest climate polluter, making up nearly 30% of global emissions.

According to international organizations' announcements, if governments fail to reduce greenhouse gas emissions worldwide by 2050, the climate change trajectory will enter an irreversible phase, and this could lead to catastrophic consequences in the decades to come, such as mass extinctions and the destruction of life on Earth [18].

According to the Paris Agreement, member countries have committed to controlling climate change. If they don't fulfill their commitments and don't reduce greenhouse gas emissions by less than 10 billion tons per year by 2050, the Earth's temperature will rise above 4 degrees, which means that nearly 70% of the world's biodiversity will be lost from terrestrial and aquatic ecosystems, and this means the destruction of the world's ecosystems [19].

As shown in **Figure 2**, Global CO_2 emissions from fossil fuels and industry, in billion tonnes, 1965–2050. The chart shows historical emissions (black), the pre-Paris policy baseline (Grey, 2015 "current policies scenario"), the policy in 2021–2023

(blue, "stated policies scenarios"), as well as pledges in 2023 (red, "announced pledges scenario") and the IEA's suggested path to staying below 1.5C (yellow, "net-zero emissions by 2050 scenario"). If fulfilled, these pledges would result in emissions following the red line in the figure above. However, even meeting these climate commitments would still fall significantly short of what is required to limit warming to below 1.5 ℃ above pre-industrial temperatures, as indicated by the yellow line (Carbon Brief analysis by Simon Evans and Verner Viisainen of IEA world energy outlooks 2015–2023). But as shown in **Figures 3** and **4**, if countries do not commit to reducing greenhouse gas emissions, we will see deaths due to air pollution in many countries every year.

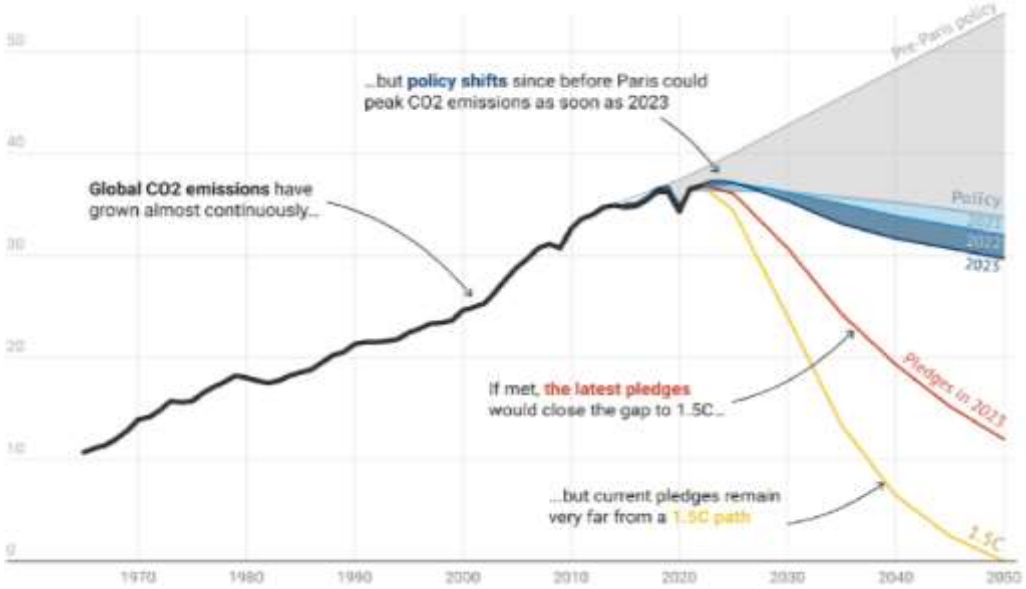

Figure 2. Global CO_2 emissions and policy scenarios.

Source: IEA[4] World energy outlooks [20].

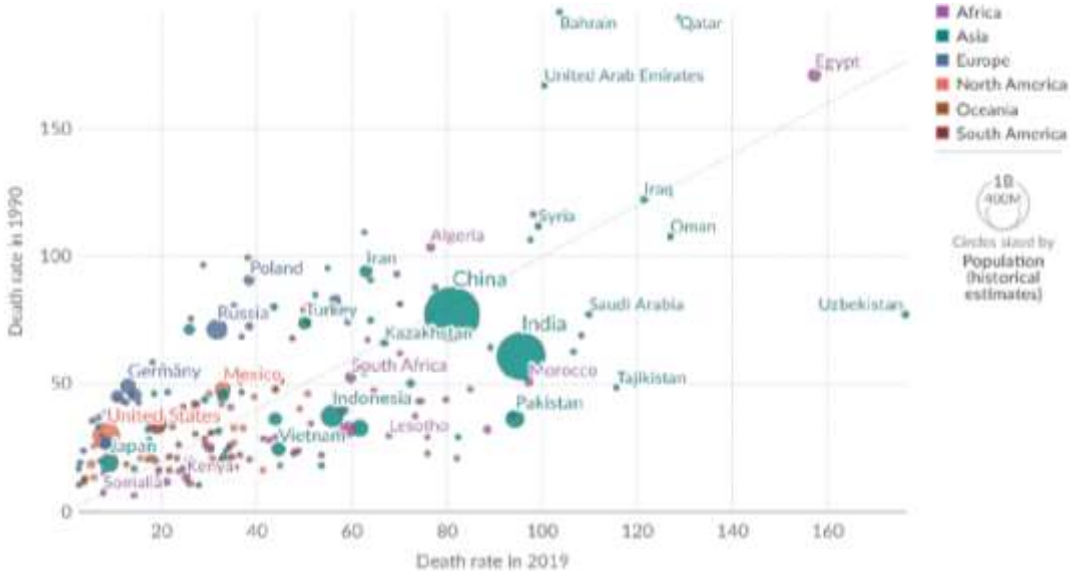

Figure 3. Death rate from outdoor air pollution in 1990 vs. 2019.

Data source: IHME, Global Burden of Disease [21]—Learn more about this data. Note: To allow comparisons between countries and over time, this metric is age-standardized. OurWorldInData.org/outdoor-air-pollution [21].

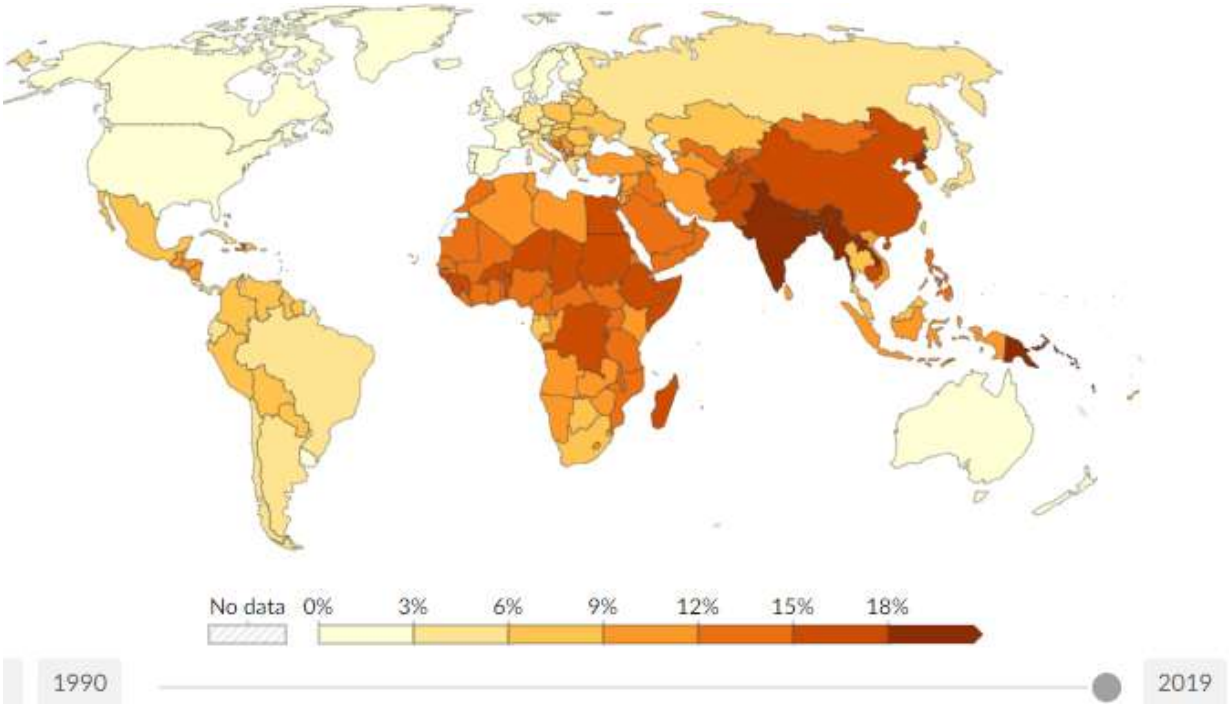

Figure 4. Share of deaths attributed to outdoor air pollution, 2019.

Note: Deaths from outdoor particulate matter air pollution per 100,000 people. Countries below the diagonal line have experienced an increased death rate, whilst those above the line have seen a decreased death rate. Data source: IHME, Global Burden of Disease [22]

Many studies focus on the impact of economic factors on environmental pollution [22–26]. One of the economic factors is foreign direct investment (FDI) and in recent decades its relationship with CO_2 emissions has been important for economic and environmental researchers. FDI indirectly affects the emission of environmental pollutants since it increases production in the country. Foreign investment has received much less attention from academic researchers compared with the relationship between economic growth and CO_2 emissions [27]. Studies such as those by Cheng and Liang [28], Feyzi [29], Kahuli and Chaaben [30], Yang and Zheng [31] show a positive relationship from FDI to pollutant emissions in the host countries. Amara et al. [32] also examine the relations between renewable CO_2 emissions, FDI, and economic growth in nine MENA countries from 2000 to 2019 using the geographic Durbin model based on spatial panel data. The empirical evidence supports the carbon emissions and FDI mediating the GDP-eco-innovation nexus Mahajan et al. [33] study the relationship between CO_2 emissions and GDP. Many climate-change studies support the positive links between GDP and trade with CO_2 emissions [34]. While several studies have examined the effects of economic factors and governance on CO_2 emissions [35–38], none of these studies have focused on the impact of governance along with economic factors on Biocracy, as well as the crucial role of governance in explaining environmental pollution in COP countries with the percentage of emissions reduction needed to meet the 1.5 degree Celsius target by 2030, among current top emitters (**Figure 5**). This research fills a gap by focusing on the impact of economic factors and governance on Biocracy.

This study investigates the following research questions:

1) What are the impacts of governance and economic factors on the Biocracy?

2) How does governance affect environmental pollution outcomes in the COP 28 member countries?

Based on the literature, the following null hypotheses are tested in this study:

H1: As GDP growth increases, Biocracy will decrease.

H2: As foreign investment increases, Biocracy will decrease.

H3: As imports increase, Biocracy will increase.

H4: As exports increase, Biocracy will decrease.

H5: As the Governance Index increases, Biocracy will increase.

H6: As the inflation rate increases, Biocracy will increase.

H7: As employment increases, Biocracy will decrease

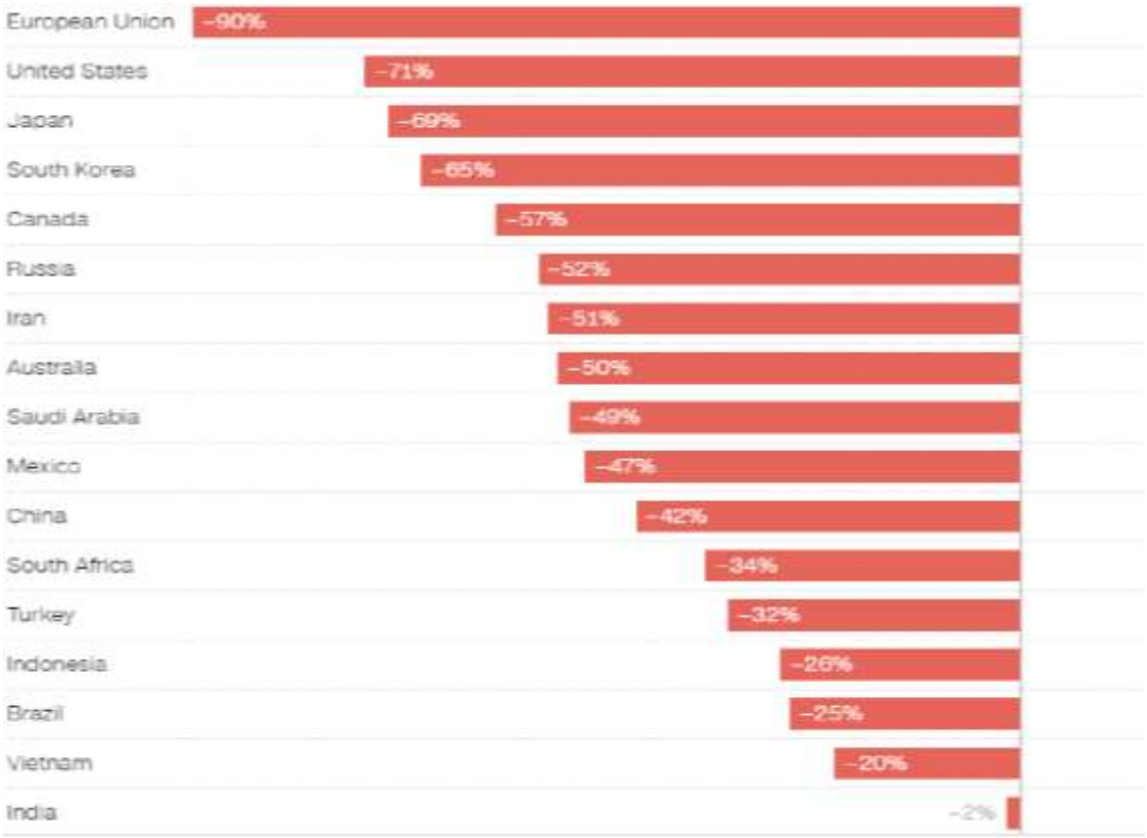

Figure 5. Percentage of emissions reduction needed to meet the 1.5-degree Celsius target by 2030, among current top emitters in COP28.

Note: This chart shows the percentage change from each country's 2022 emissions to its "fair share" emissions target, according to the Climate Action Tracker. Iraq and Pakistan are also among top 20 emitters but are not included in the Climate Action Tracker. Data updated on 20 November 2023. Sources: Climate Action Tracker, Gütschow and Pflüger [17].

2. Theoretical perspective

Biocracy refers to a system of governance or decision-making that prioritizes the well-being and health of living systems, such as ecosystems, species, and human communities. It emphasizes the importance of preserving biodiversity and the integrity of natural systems. In a Biocratic approach, decisions consider the long-term sustainability and resilience of the natural world. It seeks to redefine our relationship with nature, recognizing the intrinsic value of non-human life and ecosystem services. Biocracy encourages holistic, participatory, and adaptive management, integrating

science, traditional knowledge, and collective decision-making. The aim is to foster a mutually enriching relationship between humans and the rest of the natural world. Therefore, all human actions have an impact on Biocracy including trade.

According to a study published with Galvan et al. [39], there is a significant relationship between CO_2 emissions and trade. The study found that trade openness and FDI inflows lead to increased CO_2 emissions, while growth in GDP and services exports has a smaller but still positive impact on CO_2 emissions. Additionally, the study found that higher-income countries have a stronger positive impact of trade and FDI on CO_2 emissions compared to lower-middle-income countries.

Also, the relationship between CO_2 emissions and trade has been studied by various researchers. One notable study was conducted by Zhang et al. [40] who analyzed the nexus between CO_2 emissions, economic growth, trade openness, and FDI inflows in Latin American countries. Another study by Liu et al. [41] estimated the embodied CO_2 emissions in global trade and found significant variations across countries and products. Additionally, researchers have explored the environmental impact of trade agreements like NAFTA, suggesting that lowering trade barriers can lead to increased economic activity, changing production techniques, and subsequently affecting CO_2 emissions. The existing literature underscores the importance of examining the interplay between trade and carbon dioxide emissions, with previous findings offering a foundation for our investigation.

Foreign direct investment is another economic variable that is formed by humans and affects bureaucracy. According to the study "The Impacts of FDI Inflows on Carbon Emissions: Economic Development and Regulatory Quality as Moderators" by Huang et al. [42], FDI inflows have a positive effect on carbon emissions, while economic development and regulatory quality have a negative effect. Additionally, the study finds that FDI inflows tend to increase carbon emissions in countries with lower levels of economic development and weaker regulatory quality. The impact of FDI on environmental pollution is a vital issue that requires examination, and our research will contribute to the understanding of this critical relationship.

In addition, the inflation rate has always had a special place in the economy, so many studies have been conducted in this field. Researchers have studied the impact of carbon pricing on inflation rates. One study of Brand et al. [43] found that a €140 per ton CO_2 price would increase inflation by less than 0.2 percentage points annually. Another study suggested that the Inflation Reduction Act of 2022 could reduce emissions but may not fully offset the impact of inflation [44]. Additionally, a working paper of Moessner [45] examined how carbon pricing has affected inflation ex post across 35 OECD economies from 1995 to 2020.

Researchers have studied the impact of carbon pricing on employment, finding both positive and negative effects depending on the context and policy design [46]. In a study in the same field, Heutel [47] studied the impact of CO_2 emissions on employment in the US and found that a 10% reduction in emissions would lead to a 0.22% increase in employment. Another study proposed a carbon tax and subsidy reform that could create jobs while reducing emissions [48]. However, it's important to consider the specific context and policy design when evaluating the impact on employment.

The literature review highlights GDP growth, foreign investment, inflation rate,

employment, and trade-related variables (exports and imports) as the most critical economic factors, given the significant impact of trade on environmental pollution. Given the crucial impact of governance on environmental pollution control, the Rule of Law index is used as an explanatory variable to reduce environmental pollution and control climate change [49]. Additionally, due to the special importance of greenhouse gas emissions, including carbon dioxide, in air pollution and climate change, the percentage reduction of this variable is considered a Biocracy index in COP28 countries in this study [50].

While the interconnections between economic factors, governance, and CO_2 emissions have been investigated, the specific influence of governance and economic factors on Biocracy, as well as governance's role in addressing environmental pollution in COP countries, requires further examination. This study bridges this research gap, focusing on the critical need for emissions reduction in top-emitting countries to meet the 1.5 ℃ target by 2030.

3. Methodology

In this article, the Panel Tobit model is used following Bruno [51]; Busse et al. [52]; Khan et al. [53], and Chang [54]. In a Panel Tobit model, individual-specific and time-invariant effects are accounted for as random effects, whereas a fixed effects model is susceptible to the incidental parameter problem. However, in data-censoring applications, assuming H0: $\bar{\xi} = 0$, adding $\bar{X}i$ to the random effects Tobit model addresses the issue of unobserved heterogeneity, as suggested by Wooldridge [55].

$$Yit = \beta Xit + Ci + uit \quad t = 1,2,\ldots..,T \tag{1}$$

$$Ci = \psi + Xi\xi + \alpha i \tag{2}$$

where *Ci* represents the unobserved effect and *Xi* encompasses *Xit* for all time periods *t*. This model represents a data-censoring framework, which is the primary focus of interest.

This study employs panel data with a limited dependent variable (LDV) in its analysis. Like the Tobit method, in this model, a threshold level is defined so that the data above it is visible and the data below it is considered censored or zero.

According to the literature review, the primary economic variables that substantially influence Biocracy are GDP growth, foreign investment, inflation rate, employment, and trade-related variables (exports and imports). These factors are critical since trade significantly contributes to environmental pollution. Additionally, the Rule of Law index is employed as an explanatory variable to mitigate environmental pollution and address climate change, highlighting the essential role of governance in environmental pollution control [56].

PANEL TOBIT MODEL:

A key challenge in panel data models is estimating Limited Dependent Variable (LDV) models, which involve lagged dependent variables and serially correlated errors. Traditional methods for linear panel data models are not applicable to panel Tobit models due to their unique structure, use of lagged variables, and time-dummy variables. However, the random effects approach can be employed by specifying the error distribution conditional on regressors and maximizing the likelihood function.

This approach accommodates time-invariant, time-varying, and time-dummy variables, and offers straightforward identification under normally distributed errors [57]. The Panel Tobit model's econometric structure follows the format presented by Brown [58]:

$$y \times it = \beta' xit + uit \qquad i = 1,2, \ldots\ldots, N \quad t = 1,2, \ldots\ldots, T \tag{3}$$

$$uit = vi + \varepsilon it \qquad (vi \sim NID(0, \sigma 2v)) \quad (\varepsilon it \sim NID(0, \sigma 2\varepsilon)) \tag{4}$$

where the observed variables are:

$$yit = \{y * it \quad if \;\; y * it > 00 \quad and\; 0 \;\; otherwise \tag{5}$$

where *y* is a binary dependent variable and the x's are independent variables. The common error term, *uit* in Equation (4), exhibits temporal autocorrelation. The error component model decomposes *uit* into a time-invariant individual random effect (RE), *vi*, and a time-varying idiosyncratic random error, it. Assuming independence between *v*'s and Ɛ's, and defining *dit* = 1 for uncensored observations and *dit* = 0 for censored observations, the likelihood function for each individual, marginalized with respect to the random effect *vi*, is:

$$lit = \int \infty - \infty [1/\sigma\varepsilon \,.\, \emptyset((yit - \;\beta' xit + vi)/\sigma\varepsilon)] dit. [\Phi(-\beta' xit + vi)/\sigma\varepsilon)](1 - dit) f(vi, \sigma i) dvi \tag{6}$$

where: $\phi(.)$ represents the probability density function and $\Phi(.)$ represents the cumulative distribution function of the standard normal distribution, f (*v*i, σi) denotes a normal density with mean vi and standard deviation σi. For T_i observations, the likelihood function is:

$$Lit = \int \infty - \infty \prod t = 1t = Ti. [1\sigma\varepsilon\emptyset(yit - \;\beta' xit + vi\sigma\varepsilon)] dit. [\Phi(-\beta' xit + vi\sigma\varepsilon)](1 - dit) f(vi, \sigma i) dvi \tag{7}$$

In this study, Biocracy is the dependent variable, and the independent variables are GDP growth, foreign investment, inflation rate, employment, trade-related variables (exports and imports) and governance. All independent variables are chosen based on the Wald test and the Lm test with a significance level of 5%. Thus, all the included independent variables add significant explanatory power to the model and removing anyone reduces the model's fit. The hypothesis of random effects is not rejected by the Breusch-Pagan test, so the empirical model is as follows:

$$Biocracy = \vdash BSit \quad if \;\; yit > 0 \quad other\, wise \;\; 0 \tag{8}$$

$$y \cdot it = \beta GDPit + \beta FIit + \beta INit + \beta IMit + \beta EXPit + \beta EMPit + \beta GOVit + uit \;\; i = 1,2, \ldots, N$$
$$Uit = vi + \varepsilon it \qquad (vi \sim NID(0, \sigma 2v)) \;\; (\varepsilon it \sim NID(0, \sigma 2\varepsilon)) \tag{9}$$

$$Lit = \int \infty - \infty [1\sigma\epsilon\phi(yit \; - \; \beta GDPit - \beta FIit - \beta IMit - \beta EXPit - \beta INit - \beta EMPit - \beta GOVit + vit\sigma\epsilon)] dit.$$
$$. \; \Phi(-\beta GDPit - \beta INit - \beta EXit - \beta IMit - \beta FIit - -\beta EMPit - \beta GOVit + vit\sigma\epsilon\sigma i)(1 - dit) f(vi, \sigma i). \; \Phi \tag{10}$$

The sample likelihood function is the product of the L_i over the N individuals

$$L = \sum ln(li) \tag{11}$$

Equation (11) does not collapse into a sum because it is an integral of a product. Intercedence among the observations prevents parceling out the likelihood contribution of the *Ti* periods for the *i* individual when serial correlation is present.

Classical estimation methods are infeasible in a T-dimensional integral when the number of time periods is more than three or four.

In this paper, the feasible maximum likelihood estimation for limited dependent variable panel data is available for a particularly simple structure of the random disturbance and we use STATA for the panel Tobit models. The random effects model estimation assumes that εit is serially uncorrelated, the vi are uncorrelated across individuals, and $vi \mid xi \sim\sim NID\ (0, \sigma 2)$.

4. Data description and analyses

This study covers annual data from 2010 to 2022 for a group of member countries of the COP with the percentage of emissions reduction needed to meet the 1.5-degree Celsius target by 2030, among current top emitters (**Figure 5.**). Panel data refers to a dataset comprising a large number of cross-sectional observations (N) collected over a prolonged period (T). Panel data is a type of data that is collected over time for multiple individuals, firms, or other units of analysis. Some important properties of panel data include:

- Time dimension: Panel data has a time dimension, which allows for analysis of changes, trends, and patterns over time.
- Cross-sectional dimension: Panel data also has a cross-sectional dimension, which allows for analysis of differences between individuals, firms, or other units of analysis at a given point in time.
- Longitudinal nature: Panel data is collected over time for the same units of analysis, allowing for the study of longitudinal relationships and development.
- Repeated measurements: Panel data involves repeated measurements of the same variables over time, enabling analysis of changes and trends.

The descriptive statistics of the variables are shown in **Table 1**.

Table 1. Descriptive statistics of the variables in the model.

Variable	Maximum	Minimum	Standard Deviation	Mean
Biocracy	1.09e + 07	457.4	2610849	9812.17
Gross Domestic Production	11.43	−8.56	3.15	3.26
Employment	57.4	1.32	16.43	16.70
Foreign Direct Investment	9.37e + 11	−1.31e + 11	1.69e + 11	8.43e + 11
Inflation rate	72.30	−2.09	5981.39	3397.95
Export	1.13e + 13	7.78e + 09	2.15e + 12	1.25e + 12
Import	1.09e + 12	1.29e + 10	2.04e + 12	1.23e + 12
Governance	1.91	−1.72	0.98	0.25

Source: Research findings.

"In math, "e" stands for "exponent" and is used in scientific notation to represent a power of 10; so, "1.09e + 07" means 1.09 multiplied by 10 to the power of 7, which is equal to 10,900,000."

Initially, stationarity is assessed using Fisher's generalized unit root test [59]. The results of the Fisher test for panel data indicate that the null hypothesis of a unit root is rejected at the 5% level of significance (**Table 2**), suggesting stationarity.

Additionally, the cross-sectional correlation test using the Freeze test (**Table 2**) rejects the null hypothesis of no correlation at the 5% level of significance. To determine the appropriate model specification, a Hausman test is conducted to compare fixed and random effects models. The null hypothesis of no fixed effects is accepted (**Table 3**), leading to the selection of a random effects model.

Table 2. The Fisher unit root test results and freeze test.

Method	**Value**	***P* value**
Chi-Square and Fisher Dickey Fuller	162.21	0.01
Freeze Cross-Section Correlation	158.02	0.02

Source: Research findings.

Table 3. Hausman test results.

Test Hausman	***P* value**
Hausman Fe, Re	1.00

Source: Research findings. Notes: Breusch Pagan test probability distribution $p = 0/00$.

5. Results

In this investigation, the impacts of Economic and Governance factors on Biocracy are evaluated using the tobit panel model, and the resulting estimates are presented in **Table 4**. Governance has a positive relationship with Biocracy. An increase in governance means an increase in Biocracy. For example, as the Governance (Rule of Law) index increases, the enforcement of laws across all areas of a country intensifies. Consequently, factories causing air pollution will be compelled to halt operations unless they take corrective measures to address this issue. In the tobit panel method, the coefficients must be transformed in order to determine the elasticities (**Table 5**). The total elasticity is the effect of one percentage change in x on y. The elasticity of the Governance is 0.42. Specifically, a one percent increase in the variable is associated with a 0.42% increase in Biocracy, indicating a positive correlation between the two variables. This elasticity has the largest impact on Biocracy among all the variables studied [60,61]. Governance has a significant impact on biodiversity. Effective governance can promote conservation and sustainable use of biodiversity, while poor governance can lead to habitat destruction, overexploitation of resources, and loss of species. Some ways governance affects biodiversity include the rule of law that means governments can establish laws and policies to protect habitats, regulate resource use, and promote sustainable practices. The outcome supports the research hypothesis, indicating that enhancements in governance, as measured by the governance index, are linked to increased Biocracy development, thereby addressing the first research question.

Increasing exports decreases Biocracy (**Table 4**). Li et al. [62] also discovered a negative relationship between exports and Biocracy (reducing carbon dioxide emissions). The elasticity of exports is 0.32. This indicates that a 1% increase in exports leads to a 0.32% decrease in Biocracy, assuming all other factors remain constant. This outcome stems from the fact that boosting exports necessitates augmenting production, packaging, and marketing processes. These stages entail

increased fuel energy consumption for factory machines, transportation, and other devices, resulting in elevated environmental pollution and emissions. Notably, the byproduct of this process includes carbon dioxide, a harmful greenhouse gas [63]. The findings align with the first research question and support the research hypothesis, which posits that a higher export is associated with decreased Biocracy. Other negative effects of trade on the environment include:

- Habitat destruction: Trade in natural resources can lead to habitat destruction and degradation.
- Overexploitation: High demand for resources through trade can result in overexploitation and depletion of species populations.
- Invasive species: Trade can facilitate the intentional or accidental introduction of invasive species, which can harm native ecosystems.
- Illegal wildlife trade: Illegal trade in wildlife and wildlife products, such as rhino horn and elephant tusks, can drive population declines and even extinctions.

To mitigate the negative impacts, sustainable trade practices, certification schemes, and regulations are essential to ensure that trade supports biodiversity conservation and responsible resource use [64].

The findings suggest that an increase in imports for a COP member country has a positive impact on Biocracy. This outcome is counterintuitive, as one might expect imports to reduce domestic production, leading to decreased CO_2 emissions and increased Biocracy. However, the results indicate that imports complement rather than replace domestic production, resulting in enhanced Biocracy in COP countries. The elasticity of imports is 0.38. Specifically, a one percent increase in the variable is associated with a 0.38% increase in Biocracy.

Expanding employment opportunities diminishes Biocracy, consistent with Kopidou et al.'s [65] findings. As employment rises, domestic production increases, leading to greater machine and equipment usage, resulting in elevated carbon dioxide emissions and air pollution. Notably, the employment elasticity is −0.31, indicating that a 1% increase in employment corresponds to a 0.31% decrease in Biocracy. The outcome supports the research hypothesis.

The GDP variable also has a negative relationship with Biocracy which is similar to the finding of Kumar et al. [66]. An increase in production causes an increase in the use of fuel and energy, an increase in air pollution and a decrease in Biocracy. Notably, the GDP elasticity is −0.37, indicating that a 1% increase in employment corresponds to a 0.37% decrease in Biocracy.

Increasing Foreign Direct Investment (FDI) reduces Biocracy, consistent with Hoa et al.'s [67] finding. Rising FDI significantly impacts production, leading to increased fuel and energy consumption, air pollution, and a decrease in Biocracy. The elasticity of the consumer price is −0.26, indicating that a 1% increase in FDI corresponds to a 0.26% decrease in Biocracy.

The results indicate that an increase in the inflation rate for a COP member country has a positive effect on Biocracy, although the coefficient fails to reach statistical significance at the 5% level. This result confirms the first research question and is consistent with the study's hypothesis, suggesting a positive correlation between the inflation rate for a COP member country and Biocracy.

Table 4. The results of the tobit panel.

Variables	Coefficient Estimates	*Z* statistics	Standard Deviation Estimates	*P* value
Governance	270639.8	11.19	28185.21	0.00
Gross Domestic Production	−14920.48	−2.57	5799.77	0.01
Employment	−41575.32	−9.98	4165.46	0.00
Foreign Direct Investment	−5.39e−07	−3.15	1.71e-07	0.002
Inflation rate	841.89	0.29	2884.69	0.22
Export	−3.58e-07	−3.19	1.12e-07	0.04
Import	3.37e-07	3.24	1.04e-07	0.24
Sigma u	0.00			
Sigma e	200371.8			0.00
Rho	0.00			

Source: Research findings.

Table 5. Elasticity frequency of independent variables.

Variable	Total Elasticity	*Z* statistics	Standard Deviation Estimates
Foreign Direct Investment	−0.26 ***	−10.98	0.024
Gross Domestic Production	−0.37***	−2.80	0.13
Employment	−0.31***	−9.12	0.034
Governance	0.42***	3.81	0.11
Inflation rate	0.20	0.78	0.25
Export	−0.32***	−3.15	0.10
Import	0.38**	3.34	0.11

Notes: *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Source: Research findings.

6. Conclusions

The contemporary world faces numerous environmental challenges, with the emission of pollutants and greenhouse gases posing a significant threat to human life on the planet. However, studies on environmental mitigation and CO_2 emissions have largely overlooked the critical role of COP countries in reducing carbon dioxide emissions by 2023. This research aims to investigate the impact of six economic factors (GDP growth, foreign investment, inflation rate, employment, and trade-related variables (exports and imports)) and a governance indicator on Biocracy from 2010 to 2022 for a group of member countries of the COP with the percentage of emissions reduction needed to meet the 1.5-degree Celsius target by 2030, among current top emitters. The results indicate that the governance index and imports variable have the most significant positive effect on Biocracy. The study's objective is to identify strategies to enhance Biocracy without hindering economic growth, with an emphasis on the role of good governance. The findings are particularly challenging for COP member countries with high levels of air pollution, as various factors like GDP, exports, FDI, and employment are currently contributing to decreased Biocracy. Only governance and imports have the potential to reduce emissions while promoting economic well-being, with imports shifting emissions from the importer to the exporter. Therefore, governance emerges as the crucial factor in increasing Biocracy,

and COP countries have significant scope for improvement.

However, achieving this requires major political changes that empower civil society, NGOs, and responsive government.

This research makes suggestions to enhance governance and mitigate pollution, as follows:

Effective Policy Implementation:

1) Clear regulations: Establishing and enforcing strict environmental regulations and standards.
2) Monitoring and enforcement: Regular monitoring and enforcement of environmental laws and policies.

Transparency and Accountability:

1) Public access to information: Providing citizens with access to environmental data and information.
2) Participatory decision-making: Involving citizens, NGOs, and other stakeholders in environmental decision-making processes.
3) Accountability mechanisms: Establishing mechanisms to hold officials and polluters accountable for environmental damage.

Efficient Resource Management:

1) Sustainable resource use: Promoting sustainable use of natural resources, such as water and land.
2) Waste management: Implementing effective waste management systems to reduce pollution.

Public Education and Awareness:

1) Environmental education: Promoting environmental education and awareness among citizens.
2) Public awareness campaigns: Launching public awareness campaigns to promote environmentally friendly behaviors.

Collaboration and Partnerships:

1) Interagency coordination: Fostering coordination and cooperation among government agencies, NGOs, and private sector entities.
2) International cooperation: Collaborating with international organizations and governments to address transboundary environmental issues.

Incentives for Sustainable Practices:

1) Economic incentives: Offering economic incentives, such as tax breaks or subsidies, for sustainable practices.
2) Recognition and rewards: Recognizing and rewarding individuals and organizations that adopt environmentally friendly practices.

By implementing these measures, good governance can play a crucial role in reducing environmental pollution and promoting Biocracy.

However, good governance benefits extend beyond national borders, promoting clean technology diffusion and climate-friendly energy access in developing countries [68]. Removing trade barriers can boost clean technology trade, but developing countries face obstacles like low environmental standards and weak regulations [69]. Selected COP countries are becoming major clean technology manufacturers, and policy improvements can enhance environmental sustainability (Environmental Permitting, 2023). Effective governance is crucial to overcoming pushback against

environmental policies and promoting cleaner technologies, ensuring a sustainable future.

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Abbreviations

LDV	limited dependent variable
CO_2	Carbon dioxide
COP28	Conference of the Parties
FDI	Foreign direct investment
GDP	Gross Domestic Product
IEA	International energy agency
IHME	Institute for Health Metrics and Evaluation
IMF	International Monetary Fund
UN	UNITED NATION
UNFCCC	United Nations' Framework Convention on Climate Change
WJP	world justice project

Notes

[1] International Monetary Fund
[2] UNITED NATION
[3] UN Climate Change Conferences
[4] International Energy Agency

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