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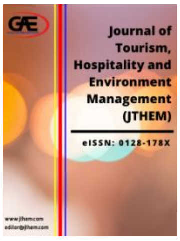

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GLOBAL ACADEMIC EXCELLENCE

ECOLOGICAL TOLL OF MILITARY ACTIVITIES ON BIODIVERSITY

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Abstract:

The primary aim of this research is to determine the relationship between military actions and their ecological impacts. A thorough analysis of panel data was undertaken, using both static and dynamic approaches, by employing average data from the years 2004 to 2022. According to the empirical evidence, the escalation in military expenditures has exerted significant strain on the natural environment. Given the significant influence of carbon emissions by the military sector, it is imperative to prioritize the inclusion of this issue on the global agenda. Our study further indicated that there is a statistically significant negative impact on the environment as a consequence of wealth and investment. The promotion of sustainable development may be accomplished through embracing renewable energy sources and energy-efficient technology, together with investing in sustainable infrastructure, so facilitating the mitigation of environmental impact. The role of governance plays a pivotal role in the mitigation of environmental harm. The notion of corruption control is concerned with the government's ability to enforce a regulatory framework that is characterized by predictability and transparency, catering to the needs of enterprises, people, and investors. Furthermore, the capacity of a government to formulate and implement policies and initiatives that successfully tackle social challenges may play a significant role in establishing a favorable framework for the preservation of the environment and the promotion of sustainability.

Keywords:

Biodiversity, Ecological Footprint, Military Expenditure

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Introduction

The primary contributors to carbon emissions are human activities, including the use of fossil fuels for energy generation, transportation purposes, industrial operations, and the widespread practice of deforestation. Human activities have resulted in a substantial elevation in atmospheric carbon dioxide (CO2) levels, thereby inducing a rise in the Earth's temperature. This phenomenon has therefore brought about alterations in precipitation patterns, sea levels, and the occurrence and severity of severe weather phenomena. The distribution and behavior of plants and animals are influenced by changes in temperature and precipitation patterns. This phenomenon has the potential to disrupt the equilibrium of ecosystems, resulting in a decrease in biodiversity and a subsequent drop in ecosystem services, such as the crucial functions of pollination and pest control. On a global scale, there has been a substantial increase in the release of carbon dioxide (CO2) since 1970. Specifically, emissions from fossil fuel burning have risen by nearly 90%, while emissions from industrial activities have grown by 78%[1].

The Kyoto Protocol, which represents the first international environmental accord, was officially ratified in December 1997. Its primary objective is to foster collaborative efforts among industrialized nations in order to effectively mitigate greenhouse gas emissions. The omission of developing nations from this agreement has been subject to criticism due to its perceived inequity and overall lack of effectiveness. Subsequently, the Paris Agreement was formulated in 2015 with the aim of enhancing the collective endeavor to address climate change, mandating both rich and developing countries to limit the rise in global temperatures to below 2 degrees Celsius. According to the Intergovernmental Panel on Climate Change (IPCC, 2014), there has been a consistent yearly growth of 2.2% in global greenhouse gas (GHG) emissions from 2000 to 2009. This trend continued with a slightly reduced rate of 1.3% from 2010 to 2019 (IPCC, 2022), despite the implementation of international climate laws and the adoption of several climate change mitigation strategies. Nevertheless, the primary emphasis of these international accords is in the mitigation of greenhouse gas emissions originating from the energy and industrial sectors, with relatively little attention given to emissions stemming from military operations.

Although military operations contribute significantly to carbon emissions, they have not received much attention in international climate accords, resulting in most nations being excused from reporting their military-related emissions (Burton & Lin, 2022). The phenomenon of militarism, characterized by the exaltation of military might and its often-associated assertive approach to international relations, may have a substantial influence on carbon emissions. The military sector is a significant consumer of energy, with a particular reliance on fossil fuels. Additionally, the emissions associated with the manufacture and transportation of weapons and military equipment add to environmental impacts (Ahmed, 2020a; 2021). Furthermore, it is important to note that armed conflicts and military engagements have the potential to significantly disrupt regular economic and energy-related operations, as well as introduce air pollution and health hazards to both human populations and ecosystems.

[1] Source: EPA (2022), and website: https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data#:~:text=Since%201970%2C%20CO2%20emissions,been%20the%20second%2Dlargest%20contributors. (accessed on 31st January 2023).

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Hynes (2014) asserts that the Iraq War resulted in the emission of about 141 million metric tons of CO2 equivalent over the period spanning from 2003 to 2007. This quantity surpasses the cumulative emissions of 139 individual countries. The military's infrastructure relies on fossil fuels, and the activities inside the military-industrial complex exhibit a high level of energy intensity (Ahmed, 2021). Militarism significantly depends on the utilization of fossil fuels, including oil and gas, for the purpose of fueling military vehicles, planes, and ships, as well as generating electricity to sustain military bases. Furthermore, it has been argued that military operations have the potential to contribute to environmental degradation, even in periods of peace (Hay-Edie, 2002). This includes the release of pollutants from military installations, exercises conducted for training purposes, as well as the transit of soldiers and equipment.

The urgency around military emissions has escalated due to increased global military operations, especially in relation to the control and possible restriction of energy resources. According to Solarin et al. (2018), the use of fossil fuels by the military sector in a given nation has the capacity to contribute to a significant rise in emissions. Simultaneously, it is often observed that military expenditure exhibits a tendency towards significant magnitudes, so diverting resources from endeavors aimed at tackling the fundamental drivers of climate change and ameliorating its consequences. Excessive allocation of resources towards military expenditures might potentially result in economic disparities and impede the progress towards adopting environmentally friendly energy alternatives. In this context, a trade-off exists between allocating resources towards military endeavors and prioritizing the pressing need of mitigating carbon emissions and combating climate change.

Hence, the objective of this study is to investigate the impact of military operations on environmental consequences via the use of panel data analysis. Gaining a deep understanding of the ramifications of militarism on the environment is vital in order to effectively tackle the pressing issue of climate change and advance the cause of sustainable development. This has notable advantages, particularly for policy makers and military entities, since it enables them to make well-informed choices on the reduction of emissions and the mitigation of their environmental and human health consequences.

Literature Review

In Keynesian economics, "military" spending generally refers to government funds allocated for maintaining and operating the armed forces, including activities like training and support services. Military Keynesianism focuses on how military spending impacts the economy, proposing it can stimulate growth by increasing demand and employment, similar to consumer spending and investment. This theory gained prominence in the 20th century, particularly during wartime and economic downturns (Tiltiņš & Šavriņa, 2015). However, some economists argue that while military spending may offer economic benefits, it can also lead to long-term inequalities and social burdens.

In contrast, Green Keynesianism suggests that government spending can drive economic growth and job creation while fostering sustainability and reducing environmental impact. This perspective emphasizes the transition to a green economy based on renewable energy, resource efficiency, and sustainable development. Harris (2013) describes Green Keynesianism as the integration of Keynesian fiscal policies with environmental objectives.

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The treadmill of production theory argues that relentless economic growth leads to environmental degradation (Schnaiberg, 1980), while the treadmill of destruction theory by Hooks and Smith (2004; 2005) expands this view by asserting that military operations, including weapon production and resource extraction, contribute directly to environmental harm, perpetuating a cycle of destruction.Ecological modernization theory, on the other hand, examines how institutions and agents integrate environmental considerations into their practices (Mol et al., 2020). Grounded in environmental economics, this theory proposes that sustained economic growth can mitigate environmental harm by promoting "rational capitalism" through regulations and development, creating a balanced approach to growth (Mol, 1995; 2001).

Studies on militarism and environmental degradation often focus on CO_2 emissions. For instance, Sana and Neila (2016) found a strong positive relationship between military spending and CO_2 emissions across 148 nations from 1980 to 2012, while Afia and Harbi (2018) observed similar results with multivariate analysis from 120 countries. The correlation between military spending and environmental impact is notably more pronounced in less developed countries with limited resources to manage militarism's effects, as shown by Jorgenson and Clark's (2016) research using PCSE regression analysis. Further, Sohag (2021) noted a negative relationship between military spending and renewable energy growth among 21 OECD countries, suggesting that resources diverted to military spending impede sustainable development. Uddin et al. (2022) confirmed that military vehicles, like fighter-bombers, significantly contribute to CO_2 emissions, with a 1% rise in military spending associated with a 0.1% increase in carbon emissions. Bildirici (2017) also documented a significant link between military expenditure and carbon emissions among G7 nations, suggesting that reducing militarism could lower emissions.

Similar studies in ASEAN countries (Zandi et al., 2019) found that increasing democracy and governance improvements reduce emissions tied to military spending. Military aircraft research by Waitz et al. (2005) highlighted higher NOx emissions from newer aircraft due to advanced engines, though fleet reductions have curbed NOx emissions at some bases. Bradford and Stoner (2017) found that military spending's environmental effects have grown more pronounced over time, particularly in developed economies. Noubissi and Poumie (2019) revealed that military spending increases CO_2, N_2O, and CH_4 emissions in Africa, with economic development exacerbating these impacts. Ahmed et al. (2020) also reported that military expenditure expands the ecological footprint, especially in countries reliant on fossil fuels, while Eregha et al. (2020) confirmed a similar effect in developing nations.

Studies like Jorgenson and Clark's (2009) further illustrate how increased military capital intensity heightens environmental burdens. Despite this empirical evidence linking militarism to environmental degradation, there is limited data on military emissions, complicating a complete understanding of these impacts. This study aims to address this gap by examining data from 2004 to 2018 with panel methodologies to strengthen evidence on the environmental effects of militarism and offer insights for mitigating these impacts.

Methodology

The treadmill of destruction idea has been recognised as a framework for understanding the environmental consequences resulting from military activity. According to the thesis, military operations are not only confined to periods of armed conflict, but also manifest during times

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of peace. These activities are characterised by high energy use, leading to the generation of emissions. In order to fulfil the aim of this study, the researchers have used a specific theoretical framework and have expanded upon the model offered by Solarin et al. (2018). The enlarged model is shown below.

$$\text{carbonemission} = f\ (\text{military, income, governance, investment}) \quad (1)$$

All variables were transformed into natural logarithms (in lower case). The estimated model can then be presented as follows:

$$\text{carbonemission}_{it} = \pi_0 + \pi_1\,\text{military}_{it} + \pi_2\,\text{income}_{it} + \pi_3\,\text{investment}_{it} + \pi_4\,\text{governance}_{it} + \varepsilon_{it} \quad (2)$$

where $\text{carbonemission}_{it}$ equals CO_2 emissions for country i at time t, a proxy for the environmental impact, military_{it} equals military expenditure for country i at time, income_{it} equals real GDP growth for country i at time t, a proxy for economic development, investment_{it} equals FDI inflow for country i at time t, a proxy for FDI technological transfer for country i at time t, governance_{it} equals governance quality for country i at time t, a proxy for institutional quality for country i at time t The parameters π_1 , π_2 , π_3 , and π_4 represent the elasticities for each of the independent variables, and ε denotes the error term.

CO_2 emissions act as a consistent metric that allows for comparison of emissions over time, providing a useful tool to track the environmental quality. The use of this indicator as a main measure in environmental assessment is prevalent owing to the ready accessibility of the associated data. Nations are increasingly prioritising efforts to reduce CO2 emissions due to its extended atmospheric lifespan and significant global warming potential relative to other greenhouse gases, therefore establishing it as a prominent driver of climate change. Within the framework of militarism, the present study posits a forecast wherein the acceleration of carbon dioxide (CO2) emissions is anticipated to occur concomitantly with the acceleration of military expenditure. This projection is attributed to the energy-intensive characteristics of military technologies and armaments, the energy-intensive procedures associated with military production, and the dependence of military infrastructure on fossil fuels (Ahmed et al., 2020a, b, 2021). The anticipated sign for this variable is positive.

Furthermore, military spending serves as a metric for assessing the extent of militaristic endeavours. The allocation of resources towards military operations and capabilities, as well as the investment in military activities and infrastructure, may be inferred from a country's prioritisation of military expenditure. This prioritisation also yields a quantifiable measure of the resources dedicated to the military. In order to enhance national security, it is imperative to increase the level of military spending. Nevertheless, it is crucial to acknowledge that an overabundance of military expenditures might potentially lead to adverse environmental repercussions, as elucidated in the aforementioned research. Therefore, the anticipated direction for this variable is positive.

Additional factors considered in assessing the environmental effect include income and investment. The pursuit of economic expansion is motivated by the aspiration for enhanced quality of life, leading to a heightened reliance on energy use and subsequently resulting in increased emissions. The impact of a developing economy on the environment is often seen as

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unfavourable due to its association with the unrestricted human demand for finite natural resources and the Earth's carrying capacity (Arrow et al., 1995; Rudolph & Figge, 2017). Moreover, as shown by Belloumi (2014), investment, as assessed by the inflow of foreign direct investment (FDI), has the capacity to provide fresh employment opportunities, ease the transfer of technological knowledge, and stimulate overall economic advancement. Nevertheless, this phenomenon may be linked to its environmental consequences, which arise from heightened use of resources, the dissemination of technologies and practises, the intensification of resource rivalry, and alterations in land utilisation. Given the observed detrimental impact of these factors on the ecosystem, it is thus predicted that the sign of these variables would be positive.

In the realm of institutional quality, it is often characterised by the effective administration of natural resources, the preservation of planetary well-being, and the provision of essential advantages for human beings. According to Kaufmann et al. (2011), governance may be seen as the exercise of power by established traditions and institutions within a nation. The notion encompasses not just governmental entities, but also societal and institutional actors, whose intricate human interactions might potentially have adverse consequences for the environment. This research, consistent with the findings of Din et al. (2014) and Habibullah et al. (2018), discovered that the governance index has significance as it serves as a measure of governance output, which encompasses the provision of services. To clarify, an elevation in the governance index would result in a decrease in the environmental footprint. Therefore, it is anticipated that the sign of this variable will be negative. Table 1 and Table 2 display the list of variables and list of 102 countries included in this study.

This research used empirical methods to evaluate the environmental damage resulting from militarization operations. The analysis was conducted using average data obtained from a sample of 102 nations throughout the period spanning from 2004 to 2018. The World Bank database provides online access to all accessible data, which may be found at the following link: https://data.worldbank.org/indicator. The data pertaining to institutional quality was sourced from the Worldwide Governance Indicators provided by the World Bank. This information may be accessed at the following link: http://info.worldbank.org/governance/wgi/index.asp.

Table 1: Summary Of Variables

Variables	Measurement	Sources	Expected sign
Carbon emission	CO_2 emissions (kt)	WDI	-
Military	Military expenditure (% of GDP)	WDI	Positive
Income	Real GDP growth (%)	WDI	Positive
Investment	Foreign direct investment, net inflows (% of GDP)	WDI	Positive
Governance	Governance index on voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption	WGI	Negative

Note: WDI is for World Development Indicator, WGI – Worldwide Governance Indicator.

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Table 2: List Of 102 Countries Included In This Study

Afghanistan	Central African Republic	Guyana	Mexico	Sierra Leone
Albania	Chad	India	Moldova	Singapore
Algeria	Chile	Indonesia	Mongolia	Slovak Republic
Angola	China	Israel	Mozambique	Slovenia
Argentina	Colombia	Italy	Nepal	South Africa
Armenia	Cote d'Ivoire	Jamaica	Netherlands	Spain
Australia	Croatia	Japan	Nicaragua	Sri Lanka
Austria	Czech Republic	Jordan	Nigeria	Sweden
Azerbaijan	Denmark	Kazakhstan	Norway	Switzerland
Bahrain	Dominican Republic	Kenya	Oman	Tanzania
Bangladesh	El Salvador	Korea, Rep.	Pakistan	Thailand
Belarus	Estonia	Kuwait	Paraguay	Tunisia
Belgium	Eswatini	Latvia	Peru	Turkey
Bolivia	Ethiopia	Lebanon	Philippines	Uganda
Bosnia and Herzegovina	Fiji	Lesotho	Poland	United Kingdom
Botswana	Finland	Lithuania	Portugal	United States
Brazil	France	Luxembourg	Romania	Uruguay
Brunei Darussalam	Germany	Madagascar	Russian Federation	Zambia
Burkina Faso	Ghana	Malawi	Rwanda	
Cameroon	Greece	Malaysia	Saudi Arabia	
Canada	Guatemala	Mali	Senegal	

The Empirical Findings

The objective of this research is to analyze the environmental consequences resulting from military operations throughout the period spanning from 2004 to 2018. The quantification of environmental effect is often conducted via the assessment of carbon dioxide (CO2) emissions, whereas military actions are commonly evaluated in terms of military spending. The model included many explanatory factors, including income, investment, and governance. The variables were subjected to a natural logarithm transformation, and both panel static and dynamic techniques were used. Regarding the static panel, this study employs three different regression models: pooled ordinary least squares (POLS), random effects (RE), and fixed effects (FE). These approaches presume that the explanatory factors have an instantaneous impact on CO2 emissions. In contrast, the use of the generalized method of moments (GMM) is employed under the framework of panel dynamic analysis, including the lagged dependent variable as a means of addressing any endogeneity concerns within the model. Endogeneity refers to a situation in which the independent variables included in a model exhibit correlation with the error term, resulting in estimates of the model parameters that are both biased and inconsistent. GMM addresses the issue of endogeneity by including lagged values of the dependent variable, hence enhancing the orthogonality between the error term and the independent variables.

The descriptive summary is shown in Table 3. In the model, the existence of outliers is often seen. The kurtosis value for all variables, with the exception of governance, exceeds 3, indicating that the data distribution is more peaked than a normal distribution, sometimes

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referred to as a leptokurtic distribution. A positive skewness score indicates that the data distribution is skewed to the right, with a greater concentration of values on the right side and a longer tail on that side. Additionally, there are fewer extreme values on the left side of the distribution.

Table 3: Descriptive Statistics

Variable	Unit	Obs	Mean	Std. Dev.	Min	Max	Kurtosis	Skewness
Carbon emission	kt	510	0.237	0.154	0.041	0.896	5.415	1.500
Military expenditure	%	510	1.930	1.533	0.270	10.993	12.491	2.669
Income	%	510	3.902	3.035	-10.658	23.905	8.378	0.775
Investment	%	510	4.231	5.592	-4.250	44.419	20.45	3.763
Governance	index	510	0.081	1.008	-1.613	2.416	2.500	0.740

Note: Asterisks *** p<0.01, ** p<0.05, * p<0.1

Table 4 showcases the correlation matrix. High correlations are typically characterized by values close to either -1 or +1, indicating a strong association between variables. The correlation matrix in Table 4 clearly indicates that military expenditure, investment and governance have positive association with carbon emissions, while income show negative association with carbon emission. Furthermore, these variables are statistically significant at least at the 5% level.

Table 4: Correlation Matrix

Variable	Carbon emission	Military expenditure	Income	Investment	Governance
Carbon emission	1.0				
Military expenditure	0.193***	1.0			
Income	- 0.098**	-0.017	1.0		
Investment	0.122***	-0.050	- 0.128***	1.0	
Governance	0.165***	0.068	- 0.302***	0.109**	1.0

Note: Asterisks *** p<0.01, ** p<0.05, * p<0.1

Several estimations were conducted in order to choose the most appropriate static models. The BPLM test was used to ascertain the appropriate choice between the POLS or RE methodology. In the event that the null hypothesis of the BPLM test was deemed invalid, the subsequent step was the implementation of the Hausman test in order to make a selection between the random effects (RE) and fixed effects (FE) models. The use of the p-value was employed to assess the degree of statistical significance. Based on the findings shown in Table 5, the fixed effects (FE) model was chosen as the most suitable approach for representing the environmental model.

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Table 5: Results Of Military Expenditure On Carbon Emissions Using Static Approaches From 2004-2018

	POLS	Random Effect	Fixed Effect	Fixed Effect Robust Standard Error
Military expenditure$_{it}$	0.185***	0.219***	0.234***	0.234***
	(0.042)	(0.050)	(0.059)	(0.079)
Income$_{it}$	-0.049*	0.018	0.025**	0.025**
	(0.029)	(0.012)	(0.012)	(0.011)
Investment$_{it}$	0.086***	0.072***	0.072***	0.072***
	(0.029)	(0.015)	(0.015)	(0.017)
Governance$_{it}$	0.089**	-0.029	-0.214***	-0.214**
	(0.035)	(0.054)	(0.079)	(0.102)
Constant	-1.775***	-1.883***	1.898***	-1.898***
	(0.074)	(0.069)	(0.041)	(0.048)
BPLM Test	0.000			
Hausman Test		0.000		
Heteroscedasticity Test			0.000	
CSD Test			0.000	
Number of groups	102	102	102	102
Number of observations	510	510	510	510

Notes: Figures in the parentheses are standard errors. $\bar{R}^2$denotes as adjusted R-squared, RMSE denotes as root mean square error, BPLM denotes as Breusch–Pagan LM test, and CSD denotes as cross-sectional dependence. All the BPLM test, Hausman test, Heteroscedasticity test, and CSD test are reported in p-values. Asterisks *, **, and *** indicate the respective 10%, 5%, and 1% significance levels.

Nevertheless, it has been shown in recent scholarly works that static analyses might be subject to bias because of the potential presence of cross-sectional dependency in panel data sets. In this research, a cross-sectional dependency (CSD) test was conducted to examine the issue at hand. The results shown in Table 5 demonstrate that the null hypothesis (H0: Cross-sectional dependence) is rejected, while the alternative hypothesis (H1: No cross-sectional reliance) is accepted. The rejection of the null hypothesis implies that alterations or disturbances in a particular variable within a country under examination will not have an impact on the same variable in other nations within the panel data set. Furthermore, the presence of heteroscedasticity indicates a lack of uniformity in the trend of the residuals' variance. When both conditional heteroscedasticity and contemporaneous correlation are present, the robust standard error estimator is used to account for these issues and modify the standard error of the preceding fixed effects findings. Hence, this research used the fixed effects model with robust standard errors to elucidate the static model.

The data indicates that a 1% rise in military spending corresponds to a 0.234% rise in carbon emissions, consistent with prior research conducted by Jorgenson and Clark (2016), Sana and Neila (2016), Bradford and Stoner (2017), Bildirici (2017), Afia and Harbi (2018), Zandi et al. (2019), Noubissi and Poumie (2019), and Uddin et al. (2022). Despite the progress made in technology and the implementation of measures to mitigate the environmental consequences of military operations, it is undeniable that this sector continues to have a certain degree of adverse influence on the environment. The reason for the need to enhance military capabilities

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is generally associated with the substantial energy requirements, mostly sourced from fossil fuels, which consequently lead to notable carbon dioxide emissions.

The generation of income and investing activities have been shown to have adverse effects on the environment. The findings of the research indicate a statistically significant and positive correlation between income and investment in their impact on CO_2 emissions. Specifically, the results suggest that for each unit rise in economic growth, there is a corresponding increase of 0.025% in CO_2 emissions. Similarly, for every increase in foreign direct investment (FDI) inflow, there is a 0.072% increase in CO_2 emissions. The findings are consistent with the previous research conducted by Kivyiro and Arminen (2014), Shahbaz et al. (2015), and Bae et al. (2017). The findings indicate that in countries with open economies and more economic transition, there is a need to increase production in order to meet the rising demand. Consequently, this leads to an increase in pollution levels inside these nations.

On the other hand, enhanced institutional quality plays a pivotal role in mitigating the environmental consequences. The computed coefficient demonstrates a statistically significant negative relationship at a 5% significance level. Specifically, a 1% improvement in governance is associated with a reduction in CO_2 emissions by 0.214%. The obtained result aligns with the research conducted by Din et al. (2014) and Habibullah et al. (2018), which also highlight the significance of improved institutional quality in terms of enforcement, stakeholder involvement, and transparency. These factors play a crucial role in ensuring the achievement of environmental protection objectives.

Table 6 displays the outcomes of the robustness test, whereby several governance variables, including voice and accountability, political stability and lack of violence, governance effectiveness, regulatory quality, rule of law, and control of corruption, were used. The model exhibits robustness across all governance measures, with the variable of interest demonstrating strong significance at a 1% level of significance for all indicators.

Table 6: Results Of Military Expenditure On Carbon Emissions Using Static Approaches From 2004-2018 With Robust

	Voice and accountability	Political stability and absence of violence	Regulatory quality	Governance effectiveness	Rule of law	Control of corruption
Military $expenditure_{it}$	0.229***	0.214**	0.196**	0.218***	0.185***	0.234***
	(0.082)	(0.085)	(0.082)	(0.078)	(0.080)	(0.079)
$Income_{it}$	0.022*	0.024**	0.023**	0.022**	0.021***	0.025**
	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.011)
$Investment_{it}$	0.070***	0.071***	0.070***	0.069***	0.067***	0.072***
	(0.016)	(0.016)	(0.016)	(0.017)	(0.016)	(0.017)
$Governance_{it}$	0.002	-0.083	-0.298***	-0.322***	-0.412	-0.214**
	(0.090)	(0.060)	(0.103)	(0.104)	(0.126)	(0.102)
Constant	-1.891***	-1.896***	-1.829***	-1.852***	-1.844***	-1.898***
	(0.048)	(0.047)	(0.051)	(0.049)	(0.048)	(0.048)

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No. of groups	102	102	102	102	102	102
No. of observations	510	510	510	510	510	510

Note: Asterisks *, **, and *** indicate the respective 10%, 5%, and 1% significance levels.

The findings derived from the Generalized Method of Moment (GMM) analysis shown in Table 7 provide evidence of a significant relationship between previous environmental impact and present environmental impact. The observed results indicate that the estimated coefficients of the lagged dependent variable in all models exhibit positive values and demonstrate statistical significance. However, the majority of the explanatory factors exhibit insignificance in elucidating the environmental effect, with the exception of wealth. While the models demonstrated consistency in the Arellano-Bond test, they did not exhibit consistency in the Sargan and Hansen tests. As a result, the static panel estimator was deemed more suitable for this investigation.

Table 7: Results Of Tourism Impact On Carbon Emissions Using Dynamic Approaches From 2004-2018

	One-Step Difference GMM	**Two-Step Difference GMM**	**One-Step System GMM**	**Two-Step System GMM**
Carbon emmision$_{it-1}$	1.086*** (0.221)	1.050*** (0.273)	0.961*** (0.025)	0.964*** (0.026)
Military expenditure$_{it}$	0.181 (0.535)	0.286 (0.614)	0.004 (0.073)	0.057 (0.071)
Income$_{it}$	0.100*** (0.032)	0.108*** (0.033)	0.052** (0.024)	0.046 (0.027)
Investment$_{it}$	0.061 (0.046)	0.063 (0.048)	0.033 (0.025)	0.053 (0.028)
Governancet$_{it}$	0.593 (0.582)	0.649 (0.588)	-0.052 (0.045)	-0.037 (0.045)
Constant			-0.082 (0.091)	-0.133 (0.099)
Number of instruments	8	8	14	14
Number of groups	102	102	102	102
Number of observations	306	306	408	408
AR (1)	0.010	0.014	0.004	0.002
AR (2)	0.623	0.767	0.360	0.451
Sargan test	0.511	-	0.245	-
Hansen test	-	0.523	-	0.106

Notes: Figures in the parentheses are standard errors. All the AR(1), AR(2), Sargan test, and Hansen test are reported in p-values. Asterisks *, **, and *** indicate the respective 10%, 5%, and 1% significance levels.

Conclusion And Policy Implications

The objective of this study is to ascertain the correlation between military operations and their ecological consequences. A comprehensive examination of panel data was conducted, including both static and dynamic methodologies, utilizing average data spanning from 2004 to 2018. The static panel methodology was used over dynamic techniques due to its inability to provide a comprehensive explanation for the correlation between military spending and CO2 emissions.

According to the empirical evidence, the escalation in military expenditures has exerted significant strain on the natural environment. Given the significant influence of military emissions, it is imperative to prioritize the inclusion of this issue on the global agenda. It is essential to provide official acknowledgment and precise documentation in national archives, while also undertaking a transition towards the decarbonization of military activities. This necessitates a comprehensive endeavor to decrease military expenditure on carbon-intensive programs and equipment, beyond mere efforts to render military infrastructure or equipment ecologically sustainable. It is essential to establish comprehensive reporting structures that prioritize transparency, particularly in nations characterized by significant military capabilities.

In addition, the empirical results of this research also suggest that wealth and investment have a statistically significant detrimental influence on the environment. Promoting sustainable development may be achieved through adopting renewable energy sources and energy-efficient technologies, as well as making investments in sustainable infrastructure, so contributing to the reduction of environmental effect. Furthermore, the implementation of a carbon pricing system may serve as a strong incentive for enterprises to mitigate their carbon emissions. This is achieved by imposing higher costs on polluting activities, so making it economically advantageous for corporations to adopt ecologically sustainable practices.

The role of governance has a crucial part in mitigating the environmental damage. The concept of controlling corruption pertains to the government's capacity to establish a regulatory framework that is both predictable and transparent for businesses, citizens, and investors. Additionally, a government's ability to devise and execute policies and programs aimed at effectively addressing societal issues can contribute to the establishment of a conducive framework for environmental protection and sustainability.

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