Environmental Impact of Business Freedom and Renewable Energy: A Global Perspective

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Abstract
This research has examined the impact of business freedom on environmental degradation in developed and developing countries from 2000 to 2022. Panel least squares and generalized method of moments have been applied for empirical analysis. Our findings show that both business freedom and renewable energy consumption have a significant and detrimental influence on environmental degradation in both developed and developing nations. Furthermore, our findings highlight the significant influence of financial development on environmental degradation in both the whole sample and developing nations. Urbanization, on the other hand, has a significant impact on environmental degradation in both developed and developing nations. Interestingly, financial development has a negative and significant impact on environmental degradation in developed nations, while energy consumption has a notable positive and significant relationship with environmental degradation across the board. These findings suggest that the encouragement of entrepreneurial independence and the use of renewable energy sources might be helpful ways for mitigating environmental damage. Addressing the negative consequences of urbanization on the environment is also critical. The short-run dynamics give useful insight for developing tailored strategies to establish a sustainable balance between economic expansion and environmental preservation at the same time.

Keywords: Business freedom, renewable energy consumption, environmental degradation, urbanization, energy consumption
JEL Codes: F41, Q30, Q56

1. Introduction
Environmental degradation refers to any negative change or disruption in the environment that is considered damaging or undesirable. The United Nations' High-Level Threat Panel has identified it as one of the Ten Threats. The United Nations International Strategy for Disaster Reduction defines environmental degradation as the environment's declining ability to meet human and ecological needs. The amount of its influence is determined by elements such as the causative agents, habitats, and local flora and fauna. Human activities contribute greatly to environmental deterioration (Tyagi et al., 2014; Audi and Ali, 2023; Ashiq et al., 2023). Furthermore, environmental degradation is the deterioration of critical natural resources such as land, water, and air, which results in unfavorable changes to ecosystems and their health. This deterioration is frequently linked to weak institutions and inadequate regulation compliance (Dinulovic et al., 2020), which is exacerbated by human activities and natural calamities. Unfortunately, impoverished regions, which are mostly populated by marginalized populations, have ongoing difficulty in mitigating these concerns (Olanipekun et al., 2019).

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Empirical statistics show that environmental difficulties such as air and water pollution, climate change, catastrophes, and drought are becoming more prevalent across the world. Various national, regional, and worldwide organizations work to address environmental deterioration, with efforts such as the Vienna Convention for the Protection of the Ozone Layer (1985), the Kyoto Protocol (1997), and the Paris Agreement (2015) serving as examples. Despite these concerted efforts, global CO2 emissions increased from 3.8 in 2000 to 4.5 in 2018, showing a continuing problem. Furthermore, there is a significant difference in CO2 emissions produced by developing and wealthy countries (World Bank, 2022). With a record high of 36.3 billion tonnes in 2021 (IEA, 2022), fossil fuel usage stands out as a substantial contribution to environmental degradation. This troubling number emphasizes the critical necessity for sustainable practices. Environmental indicators highlight the significant and ongoing threat faced by global environmental deterioration. Business freedom refers to people's unfettered ability to make autonomous company decisions in the absence of governmental or influential group involvement (Michalos, 2014; Ali et al., 2022;). Personal choice, voluntary market exchanges, unimpeded market entrance, competition, and property rights are all important components of this approach (Sart et al., 2022). Governmental institutions and laws create an enabling environment with these characteristics, allowing businesses to operate within the framework of free-market mechanisms. Economic freedom varies among worldwide economies, generating substantial scholarly research into the influence of corporate freedom on economic growth and development. Notably, available research overwhelmingly supports the positive impact of market-oriented economic frameworks on promoting growth and development (Cumhur and Ulusoy, 2021; Ali et al., 2021; Mahmood et al., 2022). The impact of business freedom on environmental quality works through a variety of processes. According to one viewpoint, increased government size may reduce environmental quality by introducing inefficiencies into government operations and state-owned firms (Islam and López, 2013; Ullah et al., 2020). Governments, on the other hand, play a critical role in establishing environmental standards, encouraging clean energy adoption, and marketing environmentally friendly goods, possibly improving environmental quality (Kulin and Johansson, 2019). It is worth noting that the influence of more commercial freedom on environmental quality is complicated. While increased corporate freedom may result in increased energy and natural resource consumption, the positive growth impact is dependent on a country's economic development status, which aligns with the concepts of the environmental Kuznets curve theory (Chen, 2022). Notably, effective resource allocation enabled by robust commercial independence may also be used to address environmental challenges proactively. This is evident in advances in energy-efficient technology and the expansion of renewable energy sources, both of which can contribute to improved environmental quality (Audi and Ali, 2016; Shahbaz et al., 2016; Mahmood et al., 2022).

Furthermore, nations with higher degrees of corporate freedom are better positioned to use market-based mechanisms such as environmental levies and tradable permit systems to enhance environmental quality. As a result, the effects of corporate freedom and government size on environmental outcomes vary depending on the predominance of these various channels. These complicated linkages highlight the need for gaining a thorough grasp of the complex relationships that drive the relationship between commercial freedom, government size, and environmental quality. The complex link between corporate freedom, government size, and environmental quality comprises a plethora of processes, each of which contributes to a nuanced depiction of their combined influence. As governments play multifaceted roles in shaping regulatory landscapes and directing resource allocation, the interplay of these factors can result in a wide range of

environmental quality outcomes, necessitating a comprehensive understanding of the dominant channels at work (Islam and López, 2013; Ali and Ali, 2016; Ullah et al., 2020; Kulin and Johansson, 2019; Chen, 2022; Mahmood et al., 2022). In theory, corporate freedom has three separate effects on environmental degradation: the size effect, the composition effect, and the technical effect. Expanded company freedom and expanded economic activity need higher inputs for goods production, resulting in increasing emissions, known as the scale effect. As a result, the components of corporate freedom, such as government size and international freedom, are expected to have an influence on environmental sustainability. Therefore, a thorough examination of the relationship between commercial freedom and environmental deterioration is critical, particularly in the settings of industrialized and emerging countries.

2. Review of Literature

This section provides a detailed literature review that includes a selection of the most significant and recent research. To begin, Grossman and Krueger (1995) explain the complex link that exists between economic growth and the environment. Environmental degradation is a ubiquitous concern in today's global landscape, impacting both industrialized and developing countries. It is critical to recognize that environmental quality has a direct impact on human health (Fei and Fang, 2021). As a result, determining the degree and causes of environmental deterioration becomes critical. Environmental deterioration is not a one-time event, but rather the result of specific economic actions (Heath & Gifford, 2006; Chi et al., 2021). An examination of the historical trajectory and trends in environmental degradation reveals a close relationship between it and commercial freedom. Corporate freedom, which allows individuals to participate in profit-seeking corporate operations, frequently fails to consider environmental consequences. Surprisingly, the convergence between corporate freedom and environmental degradation has been understudied, making this study a trailblazing addition to its field, with studies covering the full sample, rich countries, and developing countries.

Over the last two decades, worldwide attention has shifted to nurturing a clean and sustainable environment, a critical issue for human well-being. The effects of environmental degradation on human health have been extensively established, including linkages to skin cancer, lung cancer, hepatitis, and eye infections (Nasir et al., 2021). Governments play a critical role in this intricate web of economic activity by enabling investors and entrepreneurs to create the groundwork for such ventures. As a result, it is critical to examine and appreciate the complex link between commercial freedom and environmental deterioration. While the factors of environmental deterioration are a well-studied area of study (Tyagi et al., 2014; Khan et al., 2021), there is still much space for improvement and advancement. As a result, this study gains relevance by filling a research gap and contributing to the current body of knowledge.

Following the end of the Cold War, the global economic landscape witnessed the rise of capitalism as the dominant economic system underlying what has been known colloquially as the "New World Order" (NWO) (Nye, 1992; Gill, 2008). The NWO brought in a flurry of capitalist economic and commercial operations, with a strong emphasis on boosting business and economic endeavors (Tsai, 2011). This drive for more economic activity was accompanied by the global spread of the notion of corporate freedom, which was promoted as a method of facilitating such activities (Miller and Rose, 1990).

The Heritage Foundation and the Wall Street Journal created a comprehensive formula for measuring corporate freedom in 1995. This statistic included critical issues such as the ease of starting a business, acquiring licenses, terminating firms, and gaining access to energy, with

indicators such as the number of processes, time necessary (in days), and related expenses (represented as a percentage of income per capita). While these corporate freedom policies have accelerated resource utilization, they have also been related to widespread natural resource depletion (Kronenberg, 2004; Sen, 2013). This widespread loss of natural resources has altered ecosystems throughout the world (Barnett and Morse, 2013), resulting in poor environmental conditions for both humans and other living species. Environmental degradation is defined as a negative change in natural circumstances (Suhrke, 1994; Birhanu, 2014).

The growing threat of environmental deterioration has emerged as a major worldwide issue in the modern era. Various institutions and organizations, including the United Nations, have actively participated in worldwide efforts to promote awareness and alleviate environmental degradation (Haas et al., 1993; Adams, 2019). Cheng et al. (2019), Rao and Yan (2020), and others have examined the several variables impacting environmental deterioration.

The relationship between commercial operations and environmental circumstances is inextricably linked to Ricardian rent theory, which holds that resource prices play a critical role in creating an economy's economic and environmental landscape (Ricardo, 1891). Lower levels of environmental degradation are frequently correlated with greater living standards, motivating governments throughout the world to aggressively seek environmental improvements and reductions in greenhouse gas emissions. The theoretical link between corporate freedom and environmental deterioration may be explained using three separate effects: the size effect, the composition impact, and the technical effect. According to the scale effect, enhanced corporate freedom encourages more economic activity, which leads to a bigger demand for inputs in the manufacturing of commodities, resulting in higher emissions into the environment—a phenomenon known as the scale effect. However, as economic activity increases, so do concerns about environmental damage, forcing a reduction in anthropogenic emissions. The adoption of ecologically friendly procedures facilitates this decrease, which is known as the technology impact, as postulated by Grossman and Krueger (1995).

Furthermore, the composition effect asserts that growing income levels are associated with higher demand for cleaner items. Firms are driven to adopt alternative, less-polluting methods of manufacturing in response to this increased demand, thus decreasing overall pollution levels. Notably, the scale effect or the composition effect predominates depending on income level, with the scale effect typically predominating at lower income levels and the composition effect becoming more prominent as income rises and reaches a critical turning point, as explained by Halkos and Tzeremes (2013). This delicate interplay between corporate freedom, economic activity, and environmental results highlights the study's deep interconnectedness.

3. Empirical Methodology

This study embarks on an investigation into the impact of business freedom on environmental degradation within a carefully selected group of both developed and developing countries. Building upon a comprehensive review of existing literature, this research draws inspiration from the works by Grossman and Krueger (1995), Krishnan et al. (2013), Karimzadeh et al. (2014), Ali and Audi (2016), Audi and Ali (2018), Nogal-Meger (2018), Koengkan et al. (2020) and Ali et al., (2023). The multifaceted insights offered by these scholars provide a robust foundation for the present study, which seeks to contribute novel perspectives and empirical findings to the discourse surrounding the complex interplay between business freedom and environmental degradation. The functional form of the model is as follows:

$$\mathrm{END}_{it} = \mathrm{F}(\mathrm{BFR}_{it}, \mathrm{FIN}_{it}, \mathrm{ENCON}_{it}, \mathrm{RENCON}_{it}, \mathrm{URB}_{it}) \quad (1)$$

where
END = environmental degradation
BFR = business freedom
FIN= financial development
ENCON= energy consumption
RENCON= renewable energy consumption
URB= urbanization
i= set of panel countries (all the available developed and developed countries)
t= time period (2000-2022)
For examining the relationship between the explanatory variables and explained variables, the mathematical model can be converted into the econometric model. The model can be written as:

$$END_{iT} = \alpha + \beta_1 BFR_{iT} + \beta_2 FIN_{iT} + \beta_3 ENCON_{iT} + \beta_4 RENCONMP_{iT} + \beta_5 URB_{iT} + \mu_1 \quad (2)$$

where
α = intercept
β_i= slope coefficient
μ = white noise error term

3.1. Measurements of Variables and Data Sources

Environmental degradation is taken as dependent whereas business freedom, financial development, energy consumption, renewable energy consumption, and urbanization are independent variables selected in the case of developed and developing countries from 2000 to 2022.
END = environmental degradation (Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring).
BFR = business freedom "(Business freedom is an overall indicator of the efficiency of government regulation of business. The quantitative score is derived from an array of measurements of the difficulty of starting, operating, and closing a business. The business freedom score for each country is a number between 0 and 100, with 100 equaling the freest business environment. The score is based on 10 factors, all weighted equally, using data from the World Bank's Doing Business study: Starting a business—procedures (number); Starting a business—time (days); Starting a business—cost (% of income per capita); Starting a business—minimum capital (% of income per capita); Obtaining a license—procedures (number); Obtaining a license—time (days); Obtaining a license—cost (% of income per capita); Closing a business—time (years); Closing a business—cost (% of estate); and Closing a business—recovery rate (cents on the dollar)"
FIN= financial development (Domestic credit provided by the financial sector includes all credit to various sectors on a gross basis, except credit to the central government, which is net. The financial sector includes monetary authorities and deposit money banks, as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other financial corporations are finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies)
ENCON= energy consumption (Fossil fuel comprises coal, oil, petroleum, and natural gas products)
RENCON= renewable energy consumption (Renewable energy consumption is the share of renewable energy in total final energy consumption)

URB= urbanization (Urban population refers to people living in urban areas as defined by national statistical offices. The data are collected and smoothed by United Nations Population Division). The data on selected environmental degradation, financial development, energy consumption, renewable energy consumption, and urbanization have been taken from World Development Indicators a database maintained by the World Bank. The data on business freedom has been taken from the Heritage Foundation.

3.2. Econometrics Methodology

To check the stationarity of the panel data, several unit root tests have been employed, including the PP - Fisher Chi-square (PP-FC), ADF - Fisher Chi-square (ADF-FC), Im, Pesaran, and Shin W-stat (IP&S), and Levin, Lin & Chu t* (LLC) unit root tests. Panel least squares and generalized method of moments have been applied to assess the impact of explanatory variables on the dependent variable.

4. Findings and Discussion

This section of the study presents the estimated results and discussion. The empirical analysis is divided into three sections: whole sample analysis, developing countries analysis, and developed countries analysis. The estimations include descriptive statistics, correlation matrix, unit tests, panel least squares, and generalized method of moments.

The results of descriptive statistics for the whole sample analysis, developing countries analysis, and developed countries analysis are presented in Appendix Table-1A. These descriptive statistics provide information related to Kurtosis, Skewness, Standard deviation, minimum, maximum, median, and mean values of the variables. The estimated results of the whole sample analysis indicate that business freedom, environmental degradation, financial development, energy consumption, and renewable energy consumption are positively skewed, whereas urbanization is negatively skewed. In the developing countries analysis, the estimated results show that business freedom, environmental degradation, financial development, energy consumption, renewable energy consumption, and urbanization are positively skewed. Similarly, in the developed countries analysis, environmental degradation, financial development, energy consumption, and renewable energy consumption are positively skewed, while urbanization and business freedom are negatively skewed. Overall, the results of all three analyses reveal that all the selected variables have positive kurtosis.

The results of the correlation matrix are presented in Appendix Table-2A. The coefficient of correlation indicates the strength of the relationship between variables. In the whole sample analysis, developing countries analysis, and developed countries analysis, it is observed that most explanatory variables for the regression model are significantly correlated to each other. However, there is no higher correlation that creates the issue of multicollinearity among the selected independent variables.

The estimated outcomes of panel unit root tests for the whole sample analysis, developing countries analysis, and developed countries are presented in Table 1. The estimated results of PP-FC, ADF-FC, IP&S, and LLC reveal that environmental degradation, business freedom, financial development, energy consumption, renewable energy consumption, and urbanization are stationary at I(0). This indicates that in the case of the whole sample analysis, developing countries analysis, and developed countries, all the selected variables have the same order of stationarity, i.e., at the level. Therefore, panel least squares are employed to investigate the impact of explanatory variables on the explained variable.

Table-1: Unit Root Tests Results

Variables	LLC	IPS	ADF-FC	PP-FC
Whole Sample @ Level				
END	-5.25016***	4.35643***	191.325*	332.058***
BFR	-4.99467***	-2.43110***	285.368**	301.069***
FIN	-4.82850***	3.32493***	244.163*	296.099***
ENCON	-4.63776***	3.00303*	251.507**	440.698***
RENCON	2.13122**	6.34589***	199.245*	228.597***
URB	-30.9912***	-8.41601***	1337.21***	2086.24***
Developing Countries @ Level				
END	-5.35116***	3.81824*	117.482*	243.534***
BFR	-2.22322**	-1.53002*	157.724**	201.794***
FIN	-4.39001*	3.21345*	111.348*	77.6088***
ENCON	-3.83183***	4.82597***	150.917*	301.588***
RENCON	-2.56974*	3.90169***	141.240***	174.799*
URB	-9.56735***	7.89222***	554.354***	1482.93***
Developed Countries @ Level				
END	2.93824**	2.99577*	31.7923*	36.7004*
BFR	-5.75534***	-3.51653***	104.540***	78.5316***
FIN	-3.93066***	-2.25355***	71.7050***	159.922***
ENCON	-2.08536*	4.77881***	34.0925*	41.2373*
RENCON	2.58443*	6.73822***	16.2523***	11.5963***
URB	-64.0500***	-30.8276***	712.880***	523.746***

Note: The asterisks ***, ** and * denote the significant at 1%, 5% and 10% levels, respectively. LLC=Levin, Lin & Chu t*; IPS=Im, Pesaran and Shin W-stat; ADF-FC=ADF - Fisher Chi-square; PP-FC=PP - Fisher Chi-square

Environmental degradation has emerged as a paramount concern for economies worldwide. In response, the Sustainable Development Goals devised by the UNDP advocate for a "Clear Environment for All." Thus, this study scrutinizes the relationship between business freedom and environmental degradation in both developed and developing countries. The concept of business freedom, often associated with economic liberalism and market-driven economies, emphasizes individual autonomy and agency in controlling the rewards of labor, allowing for informed vocational choices (Dale and Hyslop-Margison, 2010). This aligns with the core principles of free-market capitalism, where individuals' outcomes are linked to dedication and aptitude, fostering meritocracy and entrepreneurship (Amin, 1999). While economic activities aim for higher profits, they also entail a dynamic interaction with environmental concerns. This relationship has been extensively studied, with a focus on understanding the trade-offs and synergies between business activities and environmental sustainability. The complex relationship between business freedom and environmental issues gains prominence within the discourse of sustainable development. The prevailing view emphasizes achieving economic growth while safeguarding the natural environment for present and future generations. The paradox of economic expansion and environmental protection underscores the need to critically examine the potential environmental consequences of unchecked business freedom, which may lead to resource depletion, pollution, and ecological degradation.

The provided estimated results from both the panel least squares and generalized method of moments analyses, as presented in Table-2, offer a comprehensive perspective on the impact of business freedom on environmental degradation. The consistency observed between these two methodologies enhances the robustness of our findings. The results of panel least squares and generalized method of moments, as shown in Table-2, consistently demonstrate that business freedom significantly and negatively impacts environmental degradation. In the whole sample analysis, a 1 percent increase in business freedom leads to a (-0.0106) percent reduction in environmental degradation. In developing countries, this impact is more pronounced, with a (-0.016660) percent decrease, and in developed countries, the impact is even stronger, resulting in a (-0.036657) percent decrease in environmental degradation. Our findings reveal a significant negative impact of business freedom on environmental degradation across various analyses: whole sample, developing countries, and developed countries, aligning with previous studies (Adesina and Mwamba, 2019; Majeed et al., 2021; Karimi et al., 2022). However, our results are inconsistent with those of Davidson (2000), Nogal-Meger (2018), and Golubovic (2019), highlighting the need for a balanced approach between business freedom, regulatory frameworks, and climate policies to mitigate environmental degradation.

Theoretical and empirical literature extensively examines the diverse environmental implications associated with financial development. Firstly, a robust financial system offers avenues for capital accessibility and facilitates investment endeavors, thereby stimulating economic activities that often correlate with escalated energy consumption and subsequent environmental degradation (Wen et al., 2021). Secondly, an efficient financial sector can furnish funds for the adoption of advanced technologies and energy-efficient production methods, thereby contributing to mitigating environmental degradation (Sharif et al., 2020; Ulucak and Khan, 2020). The pivotal role of a thriving financial sector in fostering economic growth and expansion is underscored by its capacity to amplify the scale of economic activities and facilitate productive endeavors. However, the intricate interplay between financial development and environmental quality necessitates a careful examination of their interrelationship to ensure sustainable growth trajectories.

The positive impact of financial development on environmental degradation in the whole sample analysis, represented by a coefficient of 0.00612, aligns with the notion that economic expansion, facilitated by financial growth, often triggers heightened energy consumption and resource utilization, ultimately contributing to environmental decline. This result underscores the importance of implementing regulatory mechanisms and green finance initiatives to ensure that financial activities are channeled towards environmentally sustainable avenues.

In developing countries, the coefficient of 0.015435 signifies an even more pronounced impact of financial development on environmental degradation. This outcome resonates with the developmental imperative of these nations, where the pursuit of economic growth may take precedence over environmental considerations due to the need for capital accumulation and technological advancement (Grossman and Krueger, 1995). However, it also highlights the urgency of fostering inclusive growth models that account for ecological well-being to mitigate potential long-term environmental repercussions.

The intriguing negative coefficient of -0.0117 associated with financial development in developed countries explains a contrasting relationship. This inverse connection implies that advanced economies, armed with well-established financial systems, are better positioned to harness financial resources for cleaner technologies and environmentally-friendly practices. This finding underscores the potential for financial institutions to drive sustainable practices and encourages

further exploration of how mature economies can leverage their financial capabilities to mitigate environmental degradation.

The divergent impacts observed across varying economic contexts underscore the complex nature of the financial development-environmental degradation relationship. While developing countries wrestle with the challenges of balancing growth and conservation, developed economies harness their financial prowess to steer economic activities towards environmentally-conscious pathways. This necessitates targeted policy interventions that align financial development with environmental preservation objectives. Our findings align with previous research conducted by Abbasi and Riaz (2016), Baloch et al. (2019), and Saud et al. (2020), demonstrating a positive and significant impact of financial development on environmental degradation in the whole sample analysis and developing countries analysis. In contrast, our results reveal a unique pattern for developed countries, where financial development exhibits a negative and significant impact on environmental degradation. This observed pattern resonates with the conclusions drawn from the studies conducted by Ozturk and Acaravci (2013) and Destek and Sarkodie (2019) regarding the relationship between financial development and environmental outcomes in developed nations.

Over the past few decades, there has been a profound surge in human activities, propelled by the rapid pace of industrialization, which has significantly amplified the demand for energy consumption. This intensified consumption of energy, particularly in industrial sectors, has been closely associated with adverse impacts on the environment. These impacts manifest in various forms, including increased greenhouse gas emissions, air and water pollution, and depletion of natural resources. As a result, the intricate relationship between energy consumption and environmental degradation has garnered substantial attention from both empirical and theoretical perspectives (Selden and Song, 1994; Jebli and Youssef, 2017; Chaudhary and Bisai, 2018).

The existing body of literature provides valuable insights into the complex interplay between energy consumption and its consequences for environmental well-being. Researchers have analyzed the nexus between energy use and environmental degradation, shedding light on how energy-intensive processes contribute to ecological harm. For instance, Selden and Song (1994) delve into the environmental consequences of economic growth and energy consumption, highlighting the intricate pathways through which increased energy use can exacerbate environmental degradation. Jebli and Youssef (2017) extend this understanding by investigating the dynamic relationship between energy consumption, economic growth, and CO2 emissions, emphasizing the need for sustainable energy policies to mitigate environmental deterioration. Chaudhary and Bisai (2018) explore the linkages between energy consumption and air pollution, emphasizing the need for effective regulatory measures to balance economic growth and environmental protection.

In the pursuit of sustainable development and environmental preservation, it is crucial to comprehend the multifaceted interactions between energy consumption and ecological well-being. By drawing from a diverse range of studies, we can glean a comprehensive understanding of the challenges posed by escalating energy demand and its implications for environmental sustainability. These insights underscore the urgency of adopting cleaner and more efficient energy sources, enhancing energy conservation efforts, and formulating robust policies that strike a harmonious balance between economic growth and environmental stewardship.

The obtained results, derived from both panel least square and generalized method of moments analyses, reveal a consistent and significant positive relationship between energy consumption and environmental degradation in the context of the whole sample analysis. This implies that as energy consumption increases by 1 percent, there is a corresponding rise of (0.024450) percent in

environmental degradation. This finding underscores the potential environmental consequences of heightened energy usage, especially in regions characterized by diverse economic activities and industrialization. However, an intriguing observation arises when examining developed countries. In these advanced economies, the impact of energy consumption takes an unexpected turn, resulting in a notable negative association with environmental degradation. This suggests that, within the developed context, a 1 percent increase in energy consumption is linked to a decrease of (-0.096867) percent in environmental degradation. This counterintuitive outcome could stem from various factors, including greater investments in cleaner technologies, stricter environmental regulations, and improved energy efficiency measures that are commonly adopted in developed nations. The findings illuminate the complex interplay between energy consumption and environmental degradation. While the overall analysis emphasizes a positive correlation, the divergent trend in developed. Our findings are in line with the research conducted by Alam et al. (2007), Rahman (2020), and Ali et al. (2021), indicating that in developing countries, energy consumption has a negative but insignificant impact on environmental degradation, consistent with the results reported by Zhang and Gao (2016) and Wang and Dong (2019). Conversely, in developed countries, our results demonstrate that energy consumption has a negative and significant impact on environmental degradation, which is consistent with the findings of Ahmed et al. (2015), Bélaïd and Youssef (2017), and Shahbaz et al. (2018).

Currently, there is a widespread focus on green growth, green jobs, and the development of a green economy, drawing significant attention from policymakers across various disciplines. The essence of the green economy lies in the utilization of renewable energy sources in contrast to depletable and mineral resources for energy production. Scholarly research (Ali et al., 2021; Wang et al., 2021; Adekoya et al., 2022) underscores that the adoption of renewable energy resources serves as a pivotal indicator in mitigating natural environmental degradation. Notably, empirical evidence suggests that progress and innovation in renewable energy resources offer an environmentally friendly alternative characterized by reduced costs and enhanced sustainability (Dincer and Dost, 1996; Dincer and Rosen, 1998).

Renewable energy resources play a crucial role in advancing environmental sustainability, as evidenced by the literature's focus on their positive impact. The incorporation of renewables into the energy matrix contributes to a more sustainable and resilient approach to energy generation and consumption. Such resources are deemed to have the potential to alleviate the adverse ecological consequences associated with traditional energy sources, such as fossil fuels. The studies by Ali et al. (2021), Wang et al. (2021), and Adekoya et al. (2022) collectively emphasize the significant role of renewable energy in curbing environmental degradation, thereby reflecting a growing recognition of its importance in shaping future policy frameworks.

Moreover, the research by Dincer and Dost (1996) and Dincer and Rosen (1998) provides a foundation for the feasibility and viability of renewable energy resources. These studies highlight the multifaceted benefits of renewables, encompassing environmental preservation, economic efficiency, and long-term sustainability. As global efforts intensify to address climate change and reduce ecological footprints, the transition towards renewable energy gains momentum as a central pillar in achieving green and sustainable economic growth. The convergence of empirical findings and theoretical frameworks underscores the urgency of embracing renewable energy solutions to pave the way for a greener and more environmentally conscious future.

The congruence between the panel least square and generalized method of moments results underlines a compelling narrative: renewable energy consumption exerts a significant and adverse impact on environmental degradation across diverse global contexts. The estimated coefficients

illuminate this relationship, with a 1 percent escalation in renewable energy consumption corresponding to a noteworthy reduction of (-0.034091) percent in environmental degradation for the entire sample. Remarkably, this consistent pattern persists when dissecting the data for developing and developed countries, showcasing a corresponding decrease of (-0.031487) percent and (-0.011737) percent, respectively. The robustness of these findings is reinforced by the alignment with prior research. Prior studies (Al-Mulali et al., 2015; Chien et al. 2021) have similarly underscored the capacity of renewable energy sources to effectively mitigate environmental degradation. The estimated coefficients serve as quantifiable evidence, indicating that a strategic shift towards greater renewable energy consumption holds promise as an ecologically sound pathway.

Notably, the coherence of the outcomes between developing and developed countries underscores the universal applicability of the inverse relationship between renewable energy consumption and environmental degradation. The estimated coefficients consistently signify that the adoption of renewable energy resources can exert a positive influence on environmental preservation, irrespective of a nation's economic status. These results lend empirical support to the growing call for global sustainability initiatives that prioritize renewable energy integration (Al-Mulali et al., 2015).

Our estimations derived from panel least square and generalized method of moments analyses provide compelling empirical substantiation for the environmental benefits of renewable energy consumption. The negative coefficients associated with this relationship affirm that a 1 percent increase in renewable energy consumption corresponds to a meaningful reduction in environmental degradation. These findings reiterate the significance of renewable energy as a key driver for promoting sustainable development and ecological well-being (Chien et al., 2021). These results are consistent with the findings of previous studies such as Karasoy and Akçay (2018), Muhammad et al. (2021), Chien et al. (2021), and Adebayo et al. (2021).

The latter half of the 20th century witnessed a surge in global urbanization, albeit with varying rates across regions and nations. Notably, Asia emerged as a hub for megacities, housing nearly half of the world's urban giants. However, consensus prevails regarding the profound and widespread environmental ramifications stemming from this urbanization trend (Ichimura, 2003; Uttara et al., 2012; Cui et al., 2019).

Urbanization serves as a catalyst for multifaceted demographic shifts, presenting a complex interplay with both development and environmental considerations. These intricate interactions have given rise to a nexus of factors with far-reaching environmental implications. The literature underscores the pivotal role of urbanization in shaping the demographic landscape and subsequently influencing development trajectories (Awan, 2013; Giljum et al., 2014; Ahmad et al., 2021). Notably, empirical investigations have illuminated the connection between densely populated urban centers and various environmental predicaments, such as air and water pollution (Rashid et al., 2018). This underscores the intrinsic link between urbanization and the amplification of pollution issues, underscoring the need for comprehensive strategies to manage these challenges effectively.

As urbanization progresses, it unveils a complex tapestry of demographic changes that intertwine with the overarching themes of development and environmental conservation. The phenomenon of urbanization extends its influence well beyond the realm of urban planning, contributing to a web of interconnected dynamics that necessitate a holistic approach to sustainable urban growth. The scholarly discourse emphasizes that the environmental repercussions of urbanization

transcend geographical boundaries, amplifying the urgency for integrated solutions that harmonize urban development with ecological preservation (Ahmad et al., 2021).

The congruence between the panel least square and generalized method of moments outcomes underscores a robust finding: urbanization exerts a notable and positive influence on environmental degradation, substantiating concerns over its intricate relationship with ecological well-being. The results consistently demonstrate that a 1 percent escalation in urbanization magnifies environmental degradation by (0.021539) percent in the entire sample, providing empirical support to the hypothesis that rapid urbanization can contribute to heightened environmental strain (Zhang et al., 2016).

This prevailing trend extends its reach to encompass both developing and developed nations, reaffirming the potency of urbanization as a driver of environmental degradation. In developing countries, a similar 1 percent upswing in urbanization results in a (0.012161) percent augmentation in environmental degradation, underscoring the global nature of the phenomenon (Liang and Yang, 2019). A comparable pattern is observed in developed countries, where a 1 percent rise in urbanization correlates with a (0.012931) percent amplification in environmental degradation, indicative of the persistent challenges presented by urbanization-driven ecological strain (Wang et al., 2021). The implications of these findings warrant careful consideration in policy and planning endeavors. While urbanization is an integral component of societal progress and economic growth, its intricate interplay with environmental quality necessitates a nuanced approach to urban development. Strategies that seek to balance the imperatives of urban expansion with ecological preservation are imperative, guided by a commitment to sustainable urbanization that minimizes its detrimental impacts on the environment (Liang and Yang, 2019). As urbanization continues to shape the global landscape, policy interventions that promote eco-friendly urban growth can contribute to a more harmonious coexistence between human habitats and the natural world. These results are consistent with the findings (Adams and Klobodu, 2017; Adebayo et al., 2021; Kahouli et al., 2022).

Table 2: Estimated Outcomes

Dependent Variable: END						
Variables	Coefficients of Panel Least Square			Coefficients of GMM		
	Whole Sample	Developing Countries	Developed Countries	Whole Sample	Developing Countries	Developed Countries
BFR	-0.0106***	-0.0166***	-0.0366***	-0.0106***	-0.0166**	-0.0366***
FIN	0.00612***	0.01543***	-0.0117***	0.00612***	0.0154***	-0.0117***
ENCON	0.02445**	-0.003028	-0.0968***	0.024450**	-0.003028	-0.0968***
RENCON	-0.0340***	-0.0314***	-0.0446***	-0.0340***	-0.0314***	-0.0446***
URB	0.02153***	0.01216***	0.01293**	0.0215***	0.0121***	0.01293**
C	10.185***	10.839***	9.985***	10.185***	10.839***	9.985***
Note: The asterisks ***, ** and * denote the significant at 1%, 5% and 10% levels, respectively.						

5. Conclusions and Suggestions

In conclusion, this study comprehensively analyzed the impact of business freedom, financial development, energy consumption, renewable energy consumption, and urbanization on environmental degradation across three distinct analytical sections: whole sample, developing countries, and developed countries. The findings reveal several noteworthy insights: Business freedom consistently demonstrates a negative and significant impact on environmental degradation

across all analyses, highlighting the importance of creating an environment conducive to business autonomy while promoting eco-friendly practices. Financial development exhibits a nuanced relationship with environmental degradation, showing a positive and significant impact in the whole sample and developing countries analyses but a negative and significant impact in developed countries. This suggests the need for tailored financial policies that balance economic growth with environmental preservation. Energy consumption emerges as a significant driver of environmental degradation in the whole sample analysis, whereas in developed countries, it shows a significant negative impact, implying a decrease in environmental degradation. These findings underscore the complex interplay between energy usage and environmental outcomes, emphasizing the importance of targeted energy conservation policies. Renewable energy consumption consistently exerts a negative and significant impact on environmental degradation across all analyses, highlighting the potential of renewable energy sources in mitigating environmental harm. Urbanization is found to have a positive and significant impact on environmental degradation across all three analyses, emphasizing the need for sustainable urban development strategies that minimize environmental impacts.

Based on these findings, several policy recommendations are proposed to mitigate environmental degradation. These include fostering business freedom while promoting eco-friendly practices, supporting clean technologies through financial incentives, implementing energy conservation policies, transitioning to renewable energy sources, and promoting sustainable urbanization. Overall, this study contributes valuable insights into the complex relationship between socio-economic factors and environmental outcomes, offering actionable policy recommendations to foster sustainable development and environmental preservation.

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Appendices

Table-1A: Descriptive Statistics

Whole Sample						
	END	BFR	FIN	ENCON	RENCON	URB
Mean	10.03269	65.04443	49.59429	5.990113	33.55023	57.39723
Median	9.989433	65.80000	36.27356	4.944034	24.82405	58.48400
Maximum	16.14896	100.0000	304.5751	33.05451	96.04110	100.0000
Minimum	5.010635	23.40000	0.000000	1.491862	0.000000	8.246000

Std. Dev.	2.150304	14.78157	42.00402	3.749210	29.72434	23.02557
Skewness	0.198519	0.077010	1.460800	2.572881	0.680734	-0.161753
Kurtosis	2.530034	2.686766	5.556863	12.35481	2.096320	2.000602
Jarque-Bera	37.15683	11.96041	1479.695	11190.16	262.1279	108.3224
Sum	23637.02	153244.7	116844.2	14112.71	79044.34	135227.9
Sum Sq. Dev.	10889.07	514555.1	4155015.	33103.24	2080729.	1248567.
Observations	2356	2356	2356	2356	2356	2356
Developing Countries						
Mean	9.733673	60.24384	36.01949	6.138745	40.44242	52.12401
Median	9.416541	58.70000	27.63901	4.976767	32.91680	50.71300
Maximum	16.14896	100.0000	157.8091	33.05451	96.04110	100.0000
Minimum	5.010635	23.40000	0.000000	1.491862	0.000000	8.246000
Std. Dev.	2.134019	12.84177	28.49965	4.143837	32.26205	23.52389
Skewness	0.305013	0.106875	1.288795	2.568859	0.293285	0.161592
Kurtosis	2.684800	3.321102	4.454683	11.81535	1.603600	2.028584
Jarque-Bera	27.99431	8.834738	520.1296	6181.328	136.2062	62.23078
Sum	13870.48	85847.47	51327.78	8747.711	57630.44	74276.71
Sum Sq. Dev.	6484.949	234833.5	1156616.	24452.05	1482156.	788004.0
Observations	1425	1425	1425	1425	1425	1425
Developed Countries						
Mean	11.42958	79.26697	97.14289	4.930583	18.46763	75.89520
Median	11.11275	80.00000	93.99192	4.269286	12.23130	77.26300
Maximum	15.56929	100.0000	304.5751	19.21795	78.21350	98.00100
Minimum	7.528332	53.70000	7.125225	1.948293	0.852800	52.78000
Std. Dev.	1.588324	11.12704	46.81503	2.455243	16.71226	11.62156
Skewness	0.182949	-0.206959	0.715212	3.213157	1.608775	-0.277158
Kurtosis	3.451800	2.311253	3.911896	16.01202	5.257828	2.223021
Jarque-Bera	7.760014	14.82419	66.06644	4835.259	354.7158	20.91419
Sum	6297.701	43676.10	53525.73	2716.751	10175.67	41818.26
Sum Sq. Dev.	1387.525	68096.10	1205406.	3315.520	153614.7	74283.42
Observations	551	551	551	551	551	551

Table-2A: Correlation Matrix

Whole Sample						
Variables	END	BFR	FIN	ENCON	RENCON	URB
END	1.000000					
BFR	0.327270***	1.000000				
FIN	0.369959***	0.611260***	1.000000			
ENCON	-0.19206***	-0.283724***	-0.23249***	1.000000		
RENCON	-0.61347***	-0.464438***	-0.39910***	0.339675***	1.000000	

URB	0.532697***	0.523992***	0.507510***	-0.293333***	-0.620359***	1.000000
Developing Countries						
END	1.000000					
BFR	0.304130***	1.000000				
FIN	0.473180***	0.458284***	1.000000			
ENCON	-0.260845***	-0.288028***	-0.203487***	1.000000		
RENCON	-0.623931***	-0.529750***	-0.529043***	0.406259***	1.000000	
URB	0.504572***	0.418138***	0.447320***	-0.361865***	-0.668261***	1.000000
Developed Countries						
END	1.000000					
BFR	0.032913	1.000000				
FIN	-0.25353***	0.501311***	1.000000			
ENCON	-0.28182***	0.059695	-0.13109***	1.000000		
RENCON	-0.53775***	0.202757***	0.174940***	0.473510***	1.000000	
URB	0.037918	0.569014***	0.278237***	0.316350***	0.125861***	1.000000
Note: The asterisks ***, ** and * denote the significant at 1%, 5% and 10% levels, respectively.						