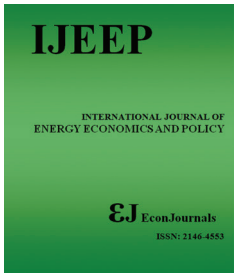

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Exploring the Nexus between Environmental Degradation and Human Health in the MENAT Region: The Role of Financial Institutions' Development

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ABSTRACT

The paper examines the role played by financial institutions' development on the nexus between environmental degradation and human health in countries in the region encompassing the Middle East, North Africa, and Turkey (MENAT). The paper argues that ecological degradation leads to better human health. However, financial institutions' development (depth, access, and efficiency) weakens the impact of environmental degradation on human health. A comparison of oil-producing and non–oil-producing countries shows that financial institutions' development influences the relationship between environmental degradation and human health. In oil-producing countries, enhanced financial institutions tend to significantly weaken the detrimental impact of environmental degradation on human health. However, in the non–oil-producing countries, human health tends to be weakly correlated with ecological degradation when the role of financial institutions is enhanced, confirming that financial institutions play a greater role in directing more funds to power plant projects, which enabled these countries to have less environmental degradation and stable levels of human health. These outcomes offer valuable guidance to policymakers regarding the role played by financial institutions' development in the link between environmental degradation and human health, driving economies in the MENAT region to promote public health by adopting more effective ecofriendly programs associated with continued development of financial institutions.

Keywords: Environmental Degradation, Financial Institutional Development, Human Health, MENAT
JEL Classifications: Q50, G2, O1, I1, I3

1. INTRODUCTION

Environmental degradation is an influencing factor that severely impacts human health by creating direct hazards and then causing many noninfectious health issues, such as respiratory ailments, heart disease, and some types of cancer. People's lives are directly exposed to these dangers because they make drinking water unsafe and air pollution high, lead to toxic chemicals, and create greenhouse gas emissions. Children and pregnant women are likely to be at higher risk of health problems related to environmental degradation. Increases in carbon dioxide (CO_2) can generate biological and chemical contamination, advancing the spread of antibiotic-resistant germs in the environment and enabling adverse health consequences for humans, wild and domesticated animals, and plants.

According to the World Health Organization (WHO), climate change generated by environmental degradation has impacted human lives and health in various ways.[1] It affects the essential elements of good health—clean air, safe drinking water, a nutritious food supply, and secure shelter—and has slowed progress in global health for decades. The WHO projects that

1 https://www.who.int/data/gho/data/themes/public-health-and-environment/.

environmental degradation will cause around 250,000 additional deaths per year between 2030 and 2050 because of malnutrition, malaria, diarrhea, and heat stress. This direct damage generated by environmental degradation would raise health costs to around USD 2-4 billion a year by 2030. Countries with weak health infrastructure—mostly in developing countries—have the least ability to cope with environmental degradation. Although massive global environmental support has been directed to build climate-resilient health systems in these countries, they still suffer long-term negative consequences of environmental degradation. Thus, authorities in these regions have called for academic and professional research collaboration to examine the impact of environmental degradation on human health. The following research question addresses these effects: Does financial institutions' development impact the relationship between environmental degradation and human health?

To overcome the negative consequences of environmental degradation on health, government authorities have taken various steps to enhance policies aimed at mitigating climate change by supporting green investment and finance, reducing environmental degradation, and smoothing technological investment. However, solid and developed financial institutions are needed for managing climate change reduction. Developed financial institutions can reshape the association between economic output and energy consumption by controlling CO_2 emissions, offering more insight into how best to support human health.

Financial institutions' development is a decreasing or an increasing function of environmental degradation. First, enhanced financial institutions could increase the amount of funding on the market, enabling businesses to invest in more productive projects and leading to more energy consumption (Udeagha and Ngepah, 2023). Financial institutions may attract foreign direct investment, promote economic growth, and intensify energy use; therefore, environmental pollution will likely increase (Arshad and Parveen, 2024). Advanced financial institutions may provide financing on very competitive terms after more funding is available on the market. Additionally, by providing easy access to finance and increasing loan offerings to different industries, especially those engaged in energy and fossil fuel exploration, financial institutions could enable businesses to employ heavy-duty equipment and household machinery that heighten CO_2 emissions (Hasanov et al., 2024). Because financial institutions are engaging in digital transformation and respond more quickly to the use of advanced technologies, which require servers, semiconductors, and data processors, more heat and greater climate contamination might be introduced, with subsequent negative consequences for human health.

However, developed financial institutions could benefit human health by reducing environmental degradation. They could support investment in more advanced technology and green investment and improve energy efficiency, thus leading to a reduction in CO_2 emissions (Habiba et al., 2022; Habiba et al., 2021; Tabash et al., 2025). Financial institutions' development could reduce environmental degradation by attracting foreign investment in research and development, which could lower financing costs and expand financing networks and resource allocation for financial assets. Highly developed financial institutions enable better application of environmental quality standards and increase the adoption of new regulatory environmental policies. Countries with greater growth in financial institutions are likely to produce less pollution because they have more innovative carbon trading programs. Finally, better financial institutions could provide innovation opportunities and, consequently, support the adoption of clean energy and environmentally friendly technology (Ahmad et al., 2022).

Based on this discussion, this paper has two main objectives. The first is to examine how environmental degradation affects human health. The second is to explore how financial institution development could reshape the link between human health and environmental degradation. Previous studies have several research gaps. First, most existing studies (e.g., Ahmad et al., 2022; Tahir et al., 2021; Hunjra et al., 2023; Mehmood et al., 2025; Nuta et al., 2025) offer evidence on the impact of financial development in the aggregate on environmental degradation, but they overlook the effect of a triangular relationship among financial development, environmental degradation, and human health. Furthermore, existing studies do not consider the impact of the constituent elements of financial institutions' development (access, depth, and efficiency) on the link between human health and environmental degradation in the MENAT region. Finally, the results in previous studies related to our research interest are mixed results and inconclusive.

The paper makes several important contributions. First, it provides a comprehensive analysis of the role played by financial institutions in the relationship between environmental quality and human health in the MENAT region, a region overlooked by previous studies. Second, it compares the pivotal role of financial institutions in this relationship in non–oil-producing and oil-producing countries. This study shows the effect of the different elements of financial institutions' development (efficiency, depth, and accessibility to financial institutions) on the relationship between environmental quality and human health in the MENAT region, which prior studies have overlooked.

The paper has some important findings. It establishes a positively significant relationship between environmental degradation and human health in the MENAT region, suggesting that air pollution enhances life expectancy (i.e., the number of years that newborns would live if normal patterns of mortality at the time of their birth remain the same over their lifetime). Our sample is divided into oil-producing and non–oil-producing countries, which have heterogeneous results. Countries in the MENAT region have enough funds to support human health, although they are highly exposed to environmental degradation. We find that financial institutions' development (accessibility, depth, and efficiency) plays a pivotal role in reshaping the relationship between environmental degradation and human health. This development supports human health by weakening the detrimental impacts of environmental degradation in oil-producing countries, confirming that better financial development creates more funding available for clean energy and sustainable investment that reduce

environmental degradation. However, in non–oil-producing countries, financial development enables people to have sufficient funds for preventing health problems and helping the community to be less exposed to environmental degradation through offering more financing for avoiding negative environmental consequences.

The rest of this study is structured as follows. Section 2 reviews the literature and develops hypotheses. The methodology and data are discussed in Section 3. Section 4 presents the analysis and results, and Section 5 gives the conclusion and policy implications.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Literature Review

The detrimental effects of environmental degradation pose a grave danger to the global ecosystem and stimulate climate change and global warming (Al-Rawashdeh et al., 2014; Rzymski et al., 2024; Balakrishnan et al., 2019; Landrigan et al., 2018; Hill et al., 2019; Shaheen et al., 2025). Given that environmental contamination represents a significant threat to public health (Bouchoucha, 2021; Majeed and Ozturk, 2020; Uddin et al., 2024; Raj and Das, 2023; Gasimli et al., 2023), understanding the nature of the impact of environmental degradation on human health in developing economies (oil-rich and oil-poor countries) is of great interest to both academics and professionals, because healthy countries can become wealthy countries (Rahman et al., 2022; Al-Shboul and Al Rawashdeh, 2022).

Extant literature argues that environmental degradation and human health are interlinked (Guo et al., 2024a; 2024b; Wang et al., 2025; Richard et al., 2024; Mimi et al., 2024; Mahalik et al., 2024; Rahman et al., 2022). However, since the industrial revolution, pollution has increased at a startling pace worldwide (Marks and McNeill, 2025), environmental degradation severely deteriorates human health because it causes chronic illnesses such as asthma, heart disease, and lung cancer, among others (Richard et al., 2024). In areas where air quality fails to meet the level recommended by the World Health Organization's, approximately 7 million people die every year because of air pollution, according to the recent reports by the Swiss organization (IQAir) on October 22nd, 2024 (https://www.iqair.com). Reductions in environmental sustainability are mainly related to increases in CO_2 emissions from fossil fuels, including coal, oil, and gas (Tariq et al., 2025). Consequently, energy from fossil fuels destroys the environment and impacts human health (Mimi et al., 2024; Mahalik et al., 2024).

Many studies have examined the effect of environmental degradation (or sustainability) on human health outcomes. The first strand of literature presents critical analyses on the impact of environmental degradation on human health. One group of studies in this strand concludes that environmental degradation harms human health because the increase in economic activities leads to more pollution. Increases in economic activities could increase industrialization and urbanization and cause greater pollution (e.g., CO_2 emissions and solid waste), harming human health. Thus, far from protecting the environment from CO_2 emissions around the world, increased economic activities may accelerate deterioration in natural conditions, which prevents healthy living and lifestyle and, consequently, reduces life expectancy.

Hill et al. (2019) argued that environmental degradation is a key factor that causes mortality across all segments of society. Balakrishnan et al. (2019) also stated that ecological degradation due to air pollution creates major universal health risks that contribute considerably to the rise in mortality and spread of disease worldwide. Using a sample of 31 highly polluted countries, Rahman et al. (2022) argued that environmental degradation, which raises carbon emissions, threatens human longevity in the long run, decreasing life expectancy. Other studies, such as Cohen et al. (2017) and Landrigan et al. (2018), found that environmental contamination has a greater effect on human health in low- and middle-income countries than in high-income countries because the former are highly exposed to air pollution due to the burning of more coal for transportation and industry and greater household use of solid fuels for cooking. They also contended that people in low- and middle-income countries might have lower life expectancy than those in high-income countries because their greater accumulation of CO_2 emissions leads to breathing problems.

Omri and Kahia (2024) indicate that the use of sophisticated technologies expanded the influence of environmental performance on human health outcomes in Saudi Arabia; it enabled policymakers to implement technology to reduce adverse environmental effects and thereby enhance health outcomes. Ofrem et al. (2024) argued that because rising temperatures could severely threaten health, stringent climate actions should be adopted to mitigate the environmental effects aimed at reducing the severity of climate change and mitigating greenhouse gas emissions.

Another group of studies, such as Devi et al. (2022), Guo et al. (2024a; 2024b), Wang et al. (2025), and Richard et al. (2024), on developing economies, found that environmental degradation reduces life expectancy. Using a sample of 36 high- and 65 middle-income countries, Mimi et al. (2024) demonstrated that residents in high-income countries have a shorter life expectancy because of higher CO_2 emissions. However, after including economic growth and technological innovation in their model, Mahalik et al. (2024) showed that stringent environmental degradation policies did not always reduce CO_2 emissions in the BRICS countries (Brazil, Russia, India, China, and South Africa).

However, the second group of studies in the first strand argued that environmental degradation has a positive impact on life expectancy. Apergis et al. (2018) examined the link between air pollution and health expenditure in the US and concluded that an increase in CO_2 emissions increases health expenditure and leads to a general improvement in human health. Amuka et al. (2018) and Kim et al. (2021) demonstrated that higher environmental degradation enhances human health in developing countries. This is because countries with higher pollution, mostly developing countries, enable people to increase their health expenditures to remain healthy (Rahman et al., 2022). Hill et al. (2019) stated that income inequality might affect the link between environmental

degradation and human health. Because higher pollution reduces life expectancy more when income equality is undermined, people in countries with weak environmental regulations and income inequality may experience better health. They argued that people with low income are likely to face health-related risks not just because they suffer from a lack of financial means to afford medical treatments but also because they are highly exposed to pollution. Thus, authorities in these countries try to reduce income inequality and enhance environmental regulations to reduce mortality rates.

Zeng and He (2019) and Shen et al. (2021) reported that, in China, air pollution due to industrial activity increases health expenditure in nearby and neighboring countries. Haseeb et al. (2019) argued that environmental degradation significantly improves health in the members of the Association of Southeast Asian Nations (ASEAN). Demir et al. (2023) stated that, because of practical steps taken by the Turkish government to improve the environment, a long-run positive relationship is reported between ecological quality and health expenditure, leading them to conclude that environmental protection improves human health.

The second strand of the literature reviewed focuses on the role of financial development (development of financial institutions) in the link between environmental degradation and human health. Given that financial development is an essential factor in reducing the effect of environmental degradation on human health, the literature has begun to investigate the role of a country's financial development on environmental degradation using global data from different sources (e.g., World Bank, International Monetary Fund [IMF]). Some papers have argued that financial development could endorse a solution that enhances economic growth while decreasing environmental degradation (Ozturk & Ullah, 2022). In general, extant literature related to the impact of financial development (development of financial institutions) on environmental quality has had different findings.

Levine (2005) predicts that financial institutions, which emit and lend capital, are among the key players that establish the framework for economic advancement and help with environmental conservation. Dietz et al. (2007) show that financial development can reshape the effect of environmental contamination through several channels. First, it helps generate greater financing opportunities for industrial development, leading to higher productivity and reducing CO_2 emissions. Second, in developing countries, financial development might mitigate the negative effect of the extensive reliance on fossil fuel sources of energy for production because it enables more green investment and financing. Developed financial institutions might promote more FDI, which might reshape the effect of the environment on health in the recipient countries. Although FDI might lead to more pollution through scale and structure effects, it might decrease pollution through the adoption of clean investment and technologies. Because of the increase in competition generated by FDI, host countries might lower their environmental standards, or at least not raise them, deteriorating human health. However, because FDI might create pollution, host countries might raise their environmental standards by implementing more resource-efficient and cleaner technologies, thus fossil fuels to be consumed in an environmentally responsible way. The other channel is that the country's financial development might enable businesses, especially in the automobile industry, to invest in green bonds and green finance, which enable a greater reduction of CO_2 emissions generated by the transportation industry (Ozturk and Ullah, 2022).

Hussain et al. (2024) find that green finance, such as sustainability-linked mortgages and environmental bonds, might reduce environmental risks by encouraging the use of renewable energy sources and pollution prevention measures. If financial institutions are slowly integrating environmental, social, and governance (ESG) standards into their investment portfolios to promote sustainable economic growth (IMF, 2025), they might not be able to mitigate CO_2 emissions. Although Chen et al. (2023) claim that financial institutions mitigate emissions, enhancing financial institutions might occasionally encourage environmentally and health-friendly projects because of ineffective regulations and political risk factors (Toolan et al., 2022).

However, other studies reach different conclusions about the impact of financial development on environmental quality. Habiba and Xinbang (2022) argue that financial institutions create high CO_2 emissions in emerging countries because they lack ecofriendly policies. Dong et al. (2024) show the positive impacts of financial institutions on the environment. Nguyen and Le (2024) conclude that financial development enhances emissions in South Asian and Asian countries. These studies suggest that financial prosperity leads to increases in the consumption of luxury goods such as automobiles and refrigerators. Empirical research indicates that expanding financial institutions could lead to greater consumption of luxury items because of the extension of more household loans, which harm the environment through higher energy use.

The connection between financial institutions and human health can take different directions (Claessens and Feijen, 2007). First, financial development could stimulate industry and innovative business activities, boosting employment and income. Income growth helps people buy healthful and nutritious foods and pays for cutting-edge hospitals, better housing, and medical centers, greatly enhancing health. Second, education is a necessary way to extend one's lifespan because economic development raises literacy levels as well as the average life span. Blau et al. (2025) argue that healthy financial institutions can promote innovation by directing funds to organizations that contribute to health-care-related innovations, which have great health benefits.

First, these studies focus on the impact of financial development in general on the environment, without considering the influence of financial institutions on environmental quality and human health. Furthermore, these analyses do not address the impact of financial institutions on the quality of the environment and health in the MENAT region. Our research framework makes a novel contribution to the literature, specifically the effect of financial institutions on the link between environmental pollution and human health in the MENAT region. Previous studies have not clarified the relationship across financial institutions, the environment, and human health. Second, this study considers the impact of the subcategories of financial institutions (access, depth,

and efficiency) on the link between environmental degradation and human health, but prior studies have rarely done so. Third, this analysis splits the MENAT area into oil-producing and non–oil-producing countries. Therefore, no clear direction emerges in the literature on the relationship between financial institutions, environmental quality, and human health, motivating our study.

2.2. Hypothesis Development

Classical economic theory argues that economic expansion and industrialization might cause environmental deterioration, but human health might be unaffected because of adaptation mechanisms such as raising health-care expenditure and advances in technology and infrastructure (Grossman and Krueger, 1995). The environmental Kuznets curve (EKC) theory states that pollution increases at lower levels of development but then declines with increases in financial stability and stronger governance (Kaika and Zervas, 2013). However, a few environmental laws, challenging weather conditions, and uneven health-care access in developing countries might put the theory in doubt. If society and governments build successful prevention mechanisms, environmental deterioration may not directly impact human health.

Prior studies have argued that air pollution causes higher mortality rates in low-income countries than in high-income countries because the former are likely to have higher exposure to CO_2 emissions from burning coal and solid fuel. People in low-income countries might have lower survival rates because of the rise in CO_2 emissions generated by increases in fossil fuel consumption (Cohen et al., 2017; Guo et al., 2024b; Landrigan et al., 2018; Omri and Kahia, 2024; Wang et al., 2025; Richard et al., 2024). However, people are likely more productive in developed countries than in developing countries because of higher investment in education and health services (Uddin, Khan, Tariq, Khan, & Malik, 2024). Mushkin and Weisbrod (1963) argue that increases in life expectancy rely not only on health services but also on providing food, housing, clothing, and education. Education might help facilitate the return on investment in health care. A supply of clean water for drinking and other activities as part of environmental health programs can reduce mortality rates (Mahalik et al., 2022). Examining the environmental and financial determinants of life expectancy in developed and developing economies remains an issue of concern to economists, sociologists, and epidemiologists. This leads to the following hypothesis:

H_1: Environmental degradation does not impact human health in the MENAT region.

The development of financial institutions affects public health and environmental quality by promoting investment in green technology, health care, and sustainable growth (Espigares and Segura, 2016; Priyan et al., 2024). However, in countries where financial institutions are not strong or are focused solely on maximizing their profit beyond the requirements of long-term investment, reducing the detrimental effect of environmental degradation on health may be insufficient (Zheng et al., 2024). According to Cihak Demirguc-Kunt and Levine (2008), financial institutions might not regularly urge ecological and health-friendly initiatives in some regions because they lack regulations and have politically related fears. If financial institutions do not actively stimulate environmental or health policies, their moderating role on the link between environmental degradation and human health might be superfluous (Subramaniam et al., 2024). This leads to the following hypothesis:

H_2: The development of financial institutions has no impact on the relationship between environmental degradation and human health in the MENAT region.

According to the resource curse theory (Sachs and Warner, 2001), oil-producing countries have fewer wealthy institutions, higher environmental destruction, and less health-care investment than non–oil-producing countries. Financial institutions in countries that produce oil might value extractive contamination over sustainable development or health enhancement (Cameron and Stanley, 2017). Conversely, non-oil-producing countries may have financial institutions that care more about environmentally friendly investment, social welfare programs, and diversity in economic growth (Sarpong and Bein, 2021). As a result, the purpose of financial institutions in controlling the environmental nexus might differ significantly between the two groups, as expressed in the following hypothesis.

H_3: Development of financial institutions impacts the relationship between environmental degradation and human health differently in oil-producing countries and non-oil-producing countries.

3. METHODOLOGY AND DATA

3.1. Methodology

To test our hypotheses on the link between human health and environmental degradation, we use a panel data multiple regression model, as follows:

$$Health_{it} = Environ_{it} + GDP_{it} + POP_{it} + MOB_{it} + COVID_{t} + \varepsilon_{it} \quad (1)$$

Where i is the country, and t is the year, respectively. $Health_{it}$ is a proxy for human health. Two proxies are used: life expectancy and birthrate. $Envir_{it}$ measures environmental degradation. We use two proxies for environmental degradation: annual total CO_2 emissions (in kilotons) (Envir1) and annual greenhouse gas emissions in kt (kiloton) of CO_2 equivalent (Envir2). POP_{it} is a proxy for population growth, in which annual population growth rate in a year is measured by the exponential growth rate of the midyear population from the previous year to the current year, expressed as a percentage. MOB_{it} is a proxy for financial technology, in the natural logarithm of population covered by mobile network technology. GDP_{it} is economic growth, measured as the natural logarithm of the gross domestic product (GDP) per capita (current USD). All these variables come from World Bank databases. *COVID* is the effect of the COVID-19 outbreak, which is a dummy variable that takes a value of one if the year is from 2020 to 2021 and zero otherwise. The error term, ε_{it}, is assumed to be normally distributed $\varepsilon_{it} \sim iid\ N(0, \sigma^2)$.

To test the suitability of fixed and random effects (FE and RE), we perform the Hausman test, and the results indicate that

random effects are more appropriate in our estimation method because the null hypothesis of the FE method is rejected. To address endogeneity, which might occur in the RE estimations, and confirm robustness, we use different estimation methods, such as the feasible generalized least squares (FGLS) method and the panel-corrected standard error (PCSE) method (Beck and Katz, 1995). These methods can deal with endogeneity and unobserved individual-specific heterogeneity by employing moment conditions at first differences and levels.

The linear regression with the PCSE method can obtain a more unbiased estimator. This method uses either ordinary least squares (OLS) or Prais–Winsten regression and assumes that the errors are, by default, heteroskedastic and simultaneously correlated across panels. Given the subsample data, we also used the FGLS method (Greene, 2012). This method can obtain unbiased estimations by considering autocorrelation AR(1), cross-sectional correlation, and heteroskedasticity across the panel data series.

To examine the impact of financial institutions' development on the link between the parameters of the variables, we estimate them as follows.

$$Health_{it} = Environ_{it} + FI \times Environ_{it} + GDP_{it} + POP_{it} + MOB_{it} + COVID_{t} + \varepsilon_{it} \quad (2)$$

where FI is a general proxy for a country's financial institutional development, taken from the World Bank Financial Development Indicators. This proxy includes one of the following: access to financial institutions (FIA), financial institutional efficiency (FIE), and financial institutional depth (FID). The error term, ε_{it}, is assumed to be normally distributed $\varepsilon_{it} \sim iid\ N(0, \sigma^2)$.

3.2. Data

Our sample consists of countries in the Middle East, North Africa and Turkey (MENAT) region for the period 2009-2023. To examine the determinants of environmental sustainability in different countries, we divide the sample of MENAT countries into two subsamples: oil-producing countries (Algeria, Iran, and the Gulf Cooperation Council [GCC] countries, i.e., the United Arab Emirates, Kingdom of Saudia Arabia, Oman, Qatar, Bahrain, and Kuwait) and non-oil-producing countries (Jordan, Egypt, Tunisia, Syria, Iran, Turkey, Yemen, Morocco, and Lebanon).

The proxies for human health, life expectancy and the birthrate, are extracted from World Bank databases. This period is selected because it captures the most recent increase in concern in MENAT countries regarding environmental improvement, given the intense attention and programs developed to continue ecological improvement and more efficient financial institutions. The data were mainly collected from the World Bank database for environmental sustainability measures. We use two measures of environmental degradation: annual total CO_2 emissions (in kilotons) and annual greenhouse gas emissions in kt (kiloton) of CO_2 equivalent.

The financial institutional development indicators are collected from IMF databases: the financial development indicators. We use three measures of financial institution development: efficiency, access, and depth indices. All the variables and their sources are defined in Table 1.

Table 2 lists descriptive statistics of the variables for the full sample and the subsamples of oil-producing and non–oil-producing countries. Both proxies for human health (life expectancy and birthrates) have minor differences across oil-producing and non–oil-producing countries. Although the mean for life expectancy is a slightly higher for oil-producing countries than non–oil-producing countries, the mean for birthrates is slightly lower.

Both proxies for environmental degradation have a higher mean with a lower standard deviation in oil-producing countries than in non–oil-producing countries. This means that, although oil-producing countries have greater environmental degradation, their variation in environmental degradation is lower than in non–oil-producing countries. In addition, financial institutional development has a higher mean, and a lower standard deviation, in oil-producing countries than in non–oil-producing countries. This confirms that financial institutions have higher development and stability in oil-producing countries than in non–oil-producing countries.

Table 3 gives the correlation coefficients for the variables used in the study. The proxies for environmental degradation are positively correlated with human health proxies, suggesting that greater environmental degradation might enhance human health. The three proxies for financial institutional development have a positive correlation with human health, suggesting that greater development by financial institutions might enhance human health. Table 3 also shows a negative correlation between the proxies for environmental degradation and for financial institutional development. This suggests that greater development by financial institutions in the MENAT region might weaken the effect of environmental degradation on human health. Finally, population growth, GDP, and IT access are positively correlated with human health, whereas COVID-19 is negatively correlated with human health.

4. RESULTS

4.1. Main Model

The results from the primary model testing H1 are reported in Table 4. Using different estimation methods, the results show that environmental degradation enhances life expectancy. This implies that CO_2 emissions due to heavy energy consumption (including solid, liquid, and gas fuels and gas flaring) and the burning of fossil fuels led to an increase in life expectancy in the MENAT region.

Our results indicate that, although countries in the MENAT region have greater environmental degradation (CO_2 emissions), people in these countries tend to live longer. Although most developing countries have higher pollution, people increase their health expenditures to remain healthy (Rahman et al., 2022). In addition, whereas some MENAT countries have higher pollution and income equality, people in these countries have better health because their governments can afford to pay for sufficient medical treatment

Table 1: Definition of variables

Variables	Definition	Source
Dependent variables		
Health1	The natural logarithm of life expectancy at birth index. This index measures life expectancy at birth, on average, which shows the lifespan of newborn infants if standard patterns of mortality at the time of their birth remain the same during their lifetime. A higher value indicates longer life expectancy.	World Bank: https://data.worldbank.org/indicator/SP.DYN.LE00.IN
Health2	The natural logarithm of the crude birthrate index. This index contains the number of live births in a year per 1,000 population estimated at midyear. A higher value indicates a higher crude birthrate.	World Bank: https://data.worldbank.org/indicator/SP.DYN.CBRT.IN
Independent variables		
Enviromental1 (Environ1)	The natural logarithm of carbon dioxide (CO_2) emissions per kt (kiloton). Carbon dioxide emissions come from the burning of fossil fuels and the manufacturing of cement. They include carbon dioxide produced during the consumption of solid, liquid, and gas fuels and gas flaring. A higher value indicates greater environmental degradation.	World Bank: https://databank.worldbank.org/metadataglossary/millennium-development-goals/series/EN.ATM.CO2E.KT
Enviromental2 (Environ2)	The natural logarithm of the annual greenhouse gas emissions in kt (kiloton) of CO_2 equivalent. It is the total greenhouse gas emissions composed of total CO_2. It excludes short-cycle biomass burning (e.g., burning of agricultural waste and savanna) but includes burning of other types of biomass (e.g., forest fires, post-burn decay, peat fires, and decay of drained peatlands), all anthropogenic CH4 sources, N_2O sources, and F-gases (HFCs, PFCs, and SF6). A higher value indicates greater environmental degradation.	World Bank: https://databank.worldbank.org/metadataglossary/world-development-indicators/series/EN.ATM.GHGT.KT.CE
Financial Institutional Access (FIA)	The accessibility component of financial institutions compiles data on bank branches per 100,000 adults and ATMs per 100,000 adults.	IMF staff, based on Cihak et al. (2012)
Financial Institutional Efficiency (FIE)	This component of financial institutions measures data on the banking sector net interest margin, lending-deposits spread, and the ratio of non-interest income to total income and overhead costs to total assets, return on assets, and return on equity.	IMF staff, based on Cihak et al. (2012)
Financial Institutional Depth (FID)	This component of financial institutions is constructed based on data on the ratio of bank credit to the private sector as a share of GDP, pension fund assets to GDP, mutual fund assets to GDP, and insurance premiums, life, and non–life insurance to GDP.	IMF staff, based on Cihak et al. (2012)
Population growth (POP)	Annual population growth rate in a year. It is measured by the exponential growth rate of the midyear population from the previous year to the current year, expressed as a percentage. The population is counted based on all residents, regardless of legal status or citizenship.	World Bank: https://data.worldbank.org/indicator/SP.POP.GROW
Gross domestic product (GDP)	The natural logarithm of the gross domestic product per capita (current USD).	World Bank: https://data.worldbank.org/indicator/NY.GDP.PCAP.CD
Population-coverage-by-mobile (MOB)	The natural logarithm of the population served by mobile network technology.	World Bank
COVID-19 (COVID)	A dummy variable that represents the outbreak of COVID-19, which takes a value of 1 in 2020, 2021, and 2022; otherwise, 0.	Author calculations

and, at the same time, can reduce income inequality. This finding aligns with the results reported by Haseeb et al. (2019) and Demir et al. (2023), who stated that environmental degradation leads to significant health improvement in the ASEAN countries and Türkiye, respectively. They also confirm the results by Amuka et al. (2018) and Kim et al. (2021), who argue that higher environmental degradation enhances human health in developing countries.

During the COVID-19 pandemic, human health tended to decline because of its severe impacts, which led to the death of thousands every day around the world, and a massive number of infections were reported in the course of 1 year. The pandemic led to an increase in respiratory ailments due to a reduction in ventilation and increased exposure to infectious diseases. During the crisis, governments were more concerned about the death rate than the effective application of environmental quality programs, so higher exposure to air pollution led to a significant decline in human health. Another interpretation is that most countries directed the majority of their health expenditures to fighting the pandemic, rather than to normal health care in hospitals, which led to deterioration in health around the world. This made families explore methods for reducing pollution-generating activities themselves, which was insufficient for fighting environmental degradation, especially with respect to particulate matter. Our results contradict the findings by Vilcins et al. (2024), who argued that COVID-10 enhanced human health. However, we confirm the results by Venter et al. (2021), who reported that, during COVID-19 lockdowns, air pollution declined in over 34 countries, which led to better human health.

Our results indicate that population growth can enhance human health, showing that life expectancy at birth in the MENAT region is mainly affected by the population increase. This is because most populations in these countries have a higher percentage of young people in good health. In other words, healthy populations who live in places with better socioeconomic development have lower mortality rates and hence greater longevity. Our results might be affected by the fact that countries in the MENAT region differ

Table 2: Summary statistics

	Full sample										
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
	LE	**BR**	**Envir1**	**Envir2**	**FIA**	**FIE**	**FID**	**COVID-19**	**POP**	**GDP**	**MOB**
count	240	240	240	240	240	240	240	240	240	240	240
mean	4.3200	2.9175	11.3168	11.6815	0.3250	0.6179	0.1695	0.1333	2.1029	9.0297	4.5805
sd	0.0551	0.3122	1.1430	1.0863	0.1737	0.1091	0.1012	0.3406	2.5931	1.2338	0.0467
min	4.1456	2.2072	9.1780	10.0268	0.036	0.179	0.015	0	-6.8521	6.0429	4.3567
max	4.3943	3.5891	13.3652	13.7009	0.755	0.756	0.564	1	13.4229	11.4931	4.6052
p50	4.3301	2.9307	11.1872	11.5090	0.3595	0.656	0.17	0	1.7694	8.7359	4.5981
p25	4.3014	2.7524	10.2511	10.6880	0.1195	0.559	0.077	0	1.0425	8.1722	4.5868
p75	4.3640	3.1095	12.2081	12.5534	0.422	0.701	0.23	0	2.5859	10.0929	4.6052
Non–oil-producing countries											
count	120	120	120	120	120	120	120	120	120	120	120
mean	4.2890	3.0458	10.8241	11.2002	0.2845	0.6092	0.1578	0.1333	1.6207	8.1502	4.5686
sd	0.0587	0.2446	1.0881	1.0092	0.1744	0.0874	0.1178	0.3414	2.3622	0.7714	0.0578
min	4.1456	2.6174	9.1780	10.0268	0.036	0.179	0.015	0	-6.8521	6.0429	4.3567
max	4.3786	3.5891	12.9435	13.1322	0.71	0.749	0.564	1	11.7940	9.4716	4.6052
p50	4.3039	2.9609	10.2830	10.7300	0.3	0.5975	0.153	0	1.4016	8.1866	4.5954
p25	4.2547	2.8738	10.1365	10.4475	0.088	0.559	0.053	0	1.0524	7.8218	4.5773
p75	4.3287	3.2274	11.6823	12.0642	0.411	0.686	0.242	0	2.3135	8.6617	4.6027
Oil-producing countries											
count	120	120	120	120	120	120	120	120	120	120	120
mean	4.3509	2.7892	11.8095	12.1628	0.3656	0.6267	0.1811	0.1333	2.5851	9.9092	4.5923
sd	0.0269	0.3206	0.9748	0.9404	0.1640	0.1270	0.0801	0.3414	2.7305	0.9498	0.0275
min	4.2842	2.2072	10.1153	10.5699	0.084	0.273	0.048	0	-2.6485	7.9181	4.4427
max	4.3943	3.3810	13.3652	13.7009	0.755	0.756	0.429	1	13.4229	11.4931	4.6052
p50	4.3560	2.8536	11.5387	12.0187	0.3845	0.6895	0.1715	0	1.9140	10.0929	4.6030
p25	4.3304	2.4791	11.1872	11.4760	0.3295	0.5675	0.1265	0	0.9770	9.1827	4.5910
p75	4.3736	3.0580	12.5619	12.8506	0.425	0.7055	0.213	0	3.4660	10.6407	4.6052

The table gives a summary of the descriptive statistics. The variables are winsorized at 1% and 99%

Table 3: Correlation matrix

Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
	LE	**BR**	**Envir1**	**Envir2**	**FIA**	**FIE**	**FID**	**COVID-19**	**POP**	**GDP**	**MOB**
LE	1										
BR	−0.7057*	1									
Envir1	0.2476*	0.1830*	1								
Envir2	0.1791*	0.1317*	0.9929*	1							
FIA	0.5699*	0.5166*	−0.1557*	−0.1832*	1						
FIE	0.1012	0.0087	−0.2654*	−0.1619	−0.1748*	1					
FID	0.5376*	0.4703*	−0.2174*	−0.1811	0.3419*	0.0909	1				
COVID-19	−0.0411	−0.1342*	−0.0011	0.0056	−0.0023	0.0602	0.0821	1			
POP	0.1583*	0.1145	−0.0481	−0.0533	−0.0008	0.1319*	−0.0352	−0.1495	1		
GDP	0.7826*	−0.7225*	0.1681*	0.1239*	0.1549*	0.0405	0.1558*	−0.038	0.1584*	1	
MOB	0.6432*	−0.4149	0.1756*	0.1148*	0.1695*	0.038	0.1644*	0.0927	0.1313*	0.1052*	1

The table lists the correlation coefficients. *Significant at the 0.05 level

significantly in terms of the population's size and growth rate. Although some countries in the GCC region have a small population, they have a higher population growth rate than Egypt, Iran, and Türkiye. However, these three countries have a significantly higher number of publications than countries in the GCC region. This indicates that some countries might have had a larger demographic transition via the increase in the proportion of young people in recent years. Thus, although these countries have various levels of environmental degradation, their populations are still healthy because of the large expenditure on improving human health.

A rise in GDP led to an increase in life expectancy, suggesting that economic growth is a lifesaving tool such that have more economic activity leads to better health. An increase in economic growth is likely to result in long-term economic expansion and to reduce the negative impact of environmental degradation (Wang et al., 2024; Dritsaki and Dritsaki, 2024). Our study confirms the findings by Guzel, Arslan, and Acaravci (2021), which indicate that life expectancy increases with higher per capita income. The results are also consistent with the findings by Rahman et al. (2022), which emphasize that GDP per capita enables a rise in life expectancy.

The use of information technology (IT), such as access to mobile phones, also enhances human health. The growth of internet use and mobile phones enables health-care providers and workers to communicate quickly, access relevant health-care information at lower cost, and collaborate internationally. Using IT also enables health-care providers to help the environment through providing lifesaving tools, such as, robotic doctors to perform special surgical intervention. It enables health-care providers to learn

Table 4: Impact of environmental degradation on human health, with life expectancy as the dependent variable

Estimation Method	REG	FE	RE	GLS	PCSE
No. of column	(1)	(2)	(3)	(4)	(5)
Dependent variable	LE	LE	LE	LE	LE
ED	0.053***	0.0548***	0.0212***	0.0153***	0.0153***
	(3.06)	(9.41)	(5.01)	(3.10)	(4.38)
COVID	−0.0095*	−0.0054*	−0.0060*	−0.0195*	−0.0195*
	(−1.73)	(−1.85)	(−1.79)	(−1.75)	(−1.80)
POP	0.0004	0.0015***	0.0013***	0.0014	0.0014
	−0.58)	(3.55)	(2.58)	(0.59)	(0.53)
GDP	0.0293***	0.0050**	0.0118***	0.0293***	0.0293***
	(17.41)	(2.10)	(4.90)	(17.63)	(18.95)
MOB	0.4910***	0.2082***	0.2883***	0.4910***	0.4910***
	(11.39)	(5.72)	(7.23)	(11.53)	(10.69)
Cons	1.8682***	2.6989***	2.6513***	1.8682***	1.8682***
	(9.83)	(15.53)	(14.39)	(9.95)	(8.97)
Year	YES	YES	YES	YES	YES
Country	YES	YES	YES	YES	YES
N	240	240	240	240	240
Adj. R^2	0.7504	0.4316	0.5654		0.9936
Hausman			6.35		
P-value			0.230		
Breusch and Pagan			390.33***		
P-value			0.000		
Wald test	144.67***	33.25***	131.03	131823.97***	102.8***

Dependent variable is life expectancy (LE). Pooled ordinary least squares regression (REG), fixed effects (FE), random effects (RE), feasible generalized least squares (GLS), and panel-corrected standard errors (PCSE). *t* statistics are in parentheses. *P<0.10, **P<0.05, and ***P<0.01

about the most recent global medical developments efficiently and quickly, saving lives and enhancing human health. The best use of the full potential of IT benefits the entire health-care system, with particular gains for patients who require complex medical treatment. On the one hand, it can lead to less pollution because it leads to reductions in pollution due to transportation, if people drive less and drive combustion engine vehicles; but it can lead to more pollution if the electricity that powers it comes from burning coal or other nongreen fuels. In addition, since running IT requires servers and semi-conductors which produce more heat and rise the temperature, it might lead to increase in healthcare issues. Hence, the overall impact is not firmly on one side. In any case, the point seems to be the energy source use to power IT.

4.2. Endogeneity

Table 5 shows the results from rerunning model 1 with an alternative measurement of human health (Birthrate). The results are quantitively similar to those in Table 4.

4.3. Impact of Financial Institutions on the Link between Environmental Degradation and Human Health

Table 6 provides the results of the impact of financial institutions on the link between environ-mental degradation and human health for the full sample, all countries. We find that financial institutions weakens the negative relationship between environmental degradation and human health. The develop-ment of financial institutions may have raised government standards through broader implementation of resource-efficient, cleaner technologies to make them environmentally responsible. This means that financial institutions in developing countries might slowly integrate ESG standards into their investment portfolios, which might encourage environmentally and health-friendly projects because of regulations and political efforts (Toolan et al., 2022). Our results are consistent with the findings by Ozturkand Ullah (2022) and Hussain et al. (2024), which found that green finance, such as sustainability-linked mortgages and ecological bonds offered by financial institutions, reduce environmental risks.

4.4. Oil-Producing and Non–oil-producing Countries

The results from testing H3 are in Tables 7 (non–oil-producing countries) and 8 (oil-producing countries). Table 7 shows that environmental degradation significantly enhances human health in non–oil-producing countries. These countries are low income and less productive because they have less economic and investment activity. Therefore, they have less industrialization and urbanization, hence, less pollution, such as CO_2 emissions and solid waste, and thereby less environmental degradation. Thus, lower levels of environmental degradation might put less pressure on the ability to maintain a healthy lifestyle and, consequently, enhance life expectancy.

Another interpretation of environmental degradation's positive effect on health is related to the environmental characteristics of the non–oil-producing countries in the MENAT region. Unlike oil-producing countries, most non–oil-producing countries are characterized by pleasant weather conditions with moderate temperatures and greater consumption of food produced domestically, agricultural abundance, and adequate housing, clothing, and education. These characteristics might help these countries produce lower CO_2 emissions and thus people are in better health. Furthermore, these countries are likely to be more productive and invest more in education and health care, so they have highly competent health services. Life expectancy involves more than just health services; therefore, higher life expectancy

Table 5: Endogeneity: Impact of environmental degradation on human health, with birthrate as the dependent variable

Estimation Method	REG	FE	RE	GLS	PCSE
No. of column	(1)	(2)	(3)	(4)	(5)
Dependent variable	BR	BR	BR	BR	BR
ED	0.0418***	0.0980*	0.0407	0.0418***	0.0418***
	(3.54)	(1.87)	(1.41)	(3.53)	(3.95)
COVID	−0.0783*	−0.0870***	−0.0898***	−0.0783**	−0.0783
	(−1.89)	(−3.32)	(−3.36)	(−2.07)	(−1.45)
POP	0.0292***	0.0209***	0.0203***	0.0292***	0.0292***
	(5.03)	(5.43)	(5.23)	(5.79)	(4.63)
GDP	0.1894***	0.0969***	0.1290***	0.1894***	0.1894***
	(14.61)	(4.55)	(7.21)	(16.38)	(18.39)
MOB	1.1886***	0.7292**	0.9699***	1.1886***	1.1886***
	(3.01)	(2.22)	(3.15)	(4.01)	(4.08)
Cons	9.5483***	5.9911***	8.0337***	9.5483***	9.5483***
	(5.36)	(3.83)	(5.69)	(7.30)	(7.53)
Year	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes
N	240	240	240	240	240
Adj. R^2	0.618	0.3919	0.6182		0.6258
Hausman			6.50		
P-value			0.1908		
Breusch and Pagan			399.06***		
P-value			0.000		
Wald test	64.51***	15.88***	109.09***	401.39***	1011.91***

BR=Birth rate as dependent variable. Pooled ordinary least squares regression (REG), fixed effect (FE), random effect (RE), feasible generalized least squares (FGLS), and panel-corrected standard errors (PCSE). *t* statistics in parentheses; *P<0.10, **P<0.05, and ***P<0.01.

might have resulted from aggregate investment by individuals, which is an effective, productive force in these countries. Most of these countries have safe water supplies and good sanitation and employ highly skilled doctors and other medical professionals as part of environmental health programs, therefore, mortality rates have fallen. Thus, life expectancy in these economies may have improved. Hence, environmental degradation might be less detrimental to human health than elsewhere.

Although the three components of financial institutions' development are significantly and positively related to human health (i.e., led to increased life expectancy), the interaction between these components and environmental degradation is significant and negative. This means that all the components (FIA, FID, and FIE) tend to reduce the effect of environmental degradation on human health. This means that greater development of financial institutions weakens the impact of environmental degradation on human health. Even nonoil producers often depend on fossil fuels for energy because of subsidies and legacy infrastructure, financial institutions' funding of coal or gas projects, worsening pollution (e.g., although large cities in Türkiye and Egypt have more pollution, the introduction of coal power plants projects enabled these countries to reduce the impact of environmental degradation on the rate of pulmonary diseases). This means that results are similar to those for the full sample on the effect of each component on the link between environmental pollution and human health.

The results for oil-producing countries reported in Table 8 are different. In oil-producing countries, environmental degradation tends to reduce life expectancy, confirming the role of theories and stylized facts. This indicates that because these countries have higher CO_2 emissions because of oil and natural resource exploration, people in these countries have shorter lifespans. Although these countries spend more on health care, they do not address the harmful effects of environmental degradation. Most of these countries have extreme heat and desertification, exacerbating climate change. Their green transition is delayed by a lack of environmental regulatory policies and financial lobbies. Health costs, such as carbon taxes or pollution controls, remain high in these countries.

The results regarding financial institutions' development are also different. The components of financial institutions involved in financial development might lead to different relationships with human health across oil-producing countries. For instance, the effect of the accessibility and efficiency of financial institutions on human health is weakly positive. However, the results show that depth in financial institutions tends to impact human health negatively and significantly, suggesting that depth reduces life expectancy. These results might be related to the differences in the structure and the operating systems of financial institutions in these countries. The GCC member countries rely heavily on dual banking systems (i.e., both Islamic and conventional banking), which help in stabilizing banking, whereas Algeria and Iran have more restrictive financial subsystems, which hinder their economies.

The results about the interaction between the components of financial institutions and environmental degradation show that the accessibility and depth of financial institutions play a role in reducing the detrimental impact of environmental degradation on

Table 6: Financial development and the link between environmental degradation and human health, full sample

FID categories	Accessibility				Depth				Efficiency			
Estimation Method	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
No. of column	FE	RE	GLS	PCSE	FE	RE	GLS	PCSE	FE	RE	GLS	PCSE
Dependent variable	LE	LE	LE	LE	LE	LE	LE	LE	LE	LE	LE	LE
ED	0.0527***	0.0391***	0.0138**	0.0190***	0.0532***	0.0416***	0.0235***	0.0215***	0.0557***	0.0429***	0.0146***	0.0751***
	(8.50)	(6.63)	(2.03)	(4.84)	(8.82)	(7.51)	(40.04)	(7.00)	(5.59)	(4.34)	(34.41)	(7.42)
FIA	0.1686	0.1725	0.5061***	0.7903***								
	(0.49)	(1.23)	(3.19)	(5.58)								
FIA×ED	−0.0276	−0.0132	−0.0371***	−0.0560***								
	(−0.62)	(−1.07)	(−2.63)	(−4.71)								
FID					0.0981	0.4798**	1.0995***	0.6818***				
					(0.40)	(2.05)	(44.12)	(3.54)				
FID×ED					−0.0252	−0.0347*	−0.0845***	−0.0407**				
					(−0.26)	(−1.80)	(−39.62)	(−2.30)				
FIE									0.0410	0.0951	0.1819***	1.3647***
									(0.26)	(0.58)	(20.81)	(6.73)
FIE×ED									−0.0030	−0.0068	−0.0142***	−0.1111***
									(−0.21)	(−0.46)	(−20.20)	(−6.80)
COVID	−0.0051*	−0.0056*	−0.0138***	−0.0071	−0.0056*	−0.0066**	−0.0173***	−0.0119**	−0.0052*	−0.0061*	−0.0158***	−0.0145***
	(−1.75)	(−1.77)	(−4.20)	(−1.49)	(−1.90)	(−2.17)	(−42.41)	(−2.34)	(−1.75)	(−1.94)	(−44.45)	(−2.86)
POP	0.0017***	0.0014***	0.0014**	0.0016	0.0019***	0.0019***	0.0014***	0.0025**	0.0017***	0.0015***	0.0014***	0.0006
	(3.86)	(2.97)	(2.00)	(1.46)	(4.09)	(4.06)	(19.52)	(2.30)	(3.82)	(3.20)	(28.63)	(0.43)
GDP	0.0043*	0.0040*	0.0059*	−0.0031	0.0048**	0.0045*	0.0062***	−0.0039	0.0048**	0.0041*	0.0067***	−0.0048
	(1.90)	(1.66)	(1.86)	(−1.15)	(2.16)	(1.92)	(22.49)	(−1.11)	(2.13)	(1.75)	(43.16)	(−1.36)
MOB	0.1590***	0.2050***	0.2015***	0.4562***	0.1708***	0.1860***	0.1276***	0.4072***	0.1782***	0.2021***	0.2081***	0.6824***
	(4.12)	(5.13)	(3.98)	(6.90)	(4.91)	(5.17)	(16.84)	(5.83)	(5.05)	(5.46)	(41.45)	(9.93)
Cons	2.8747***	2.8268***	3.0636***	2.0477***	2.8020***	2.8646***	3.2814***	2.2674***	2.7436***	2.7892***	3.0137***	0.3974
	(14.70)	(13.96)	(13.22)	(7.99)	(16.70)	(16.75)	(86.72)	(8.53)	(14.69)	(14.38)	(128.24)	(1.17)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	240	240	240	240	240	240	240	240	240	240	240	240
Adj. R^2	0.4386	0.4169		0.5850	0.381	0.4235		0.5428	0.4333	0.4201		0.5056
Hausman		27.28***				27.89***				28.82***		
P-value		0.0003				0.0002				0.0002		
Breusch and Pagan		734.76***				953.65***				727.04***		
P-value		0.0000				0.0000				0.0000		
Wald test	24.22***	133.40***	106.60***	820.61***	24.34***	150.29***	116.91***	697.55***	23.67***	134.89***	20386.28***	309.7***

Dependent variable is life expectancy (LE). Pooled ordinary least squares regression (REG), fixed effect (FE), random effect (RE), feasible generalized least squares (GLS), and panel-corrected standard errors (PCSE). *t* statistics are in parentheses. *P<0.10, **P<0.05, and ***P<0.01

Table 7: Non–oil-producing countries: Financial institutions' development and the link between environmental degradation and human health

FID categories	Accessibility				Depth				Efficiency			
Estimation method	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
No. of column	FE	RE	GLS	PCSE	FE	RE	GLS	PCSE	FE	RE	GLS	PCSE
Dependent variable	LE	LE	LE	LE	LE	LE	LE	LE	LE	LE	LE	LE
ED	0.0454***	0.0307***	0.0106***	0.0131***	0.0494***	0.0290***	0.0212***	0.0291***	0.0488***	0.0467***	0.0237**	0.1467***
	(5.10)	(3.63)	(3.96)	(3.33)	(6.00)	(3.93)	(6.87)	(5.06)	(2.88)	(2.65)	(2.45)	(5.82)
FIA	0.3971	0.5707**	0.7136***	0.7798***								
	(0.31)	(2.15)	(8.70)	(5.44)								
FIA×ED	−0.0462	−0.0388*	−0.0447***	−0.0466***								
	(0.59)	(−1.65)	(−6.26)	(−3.88)								
FID					0.3369	1.4093***	1.1302***	1.4626***				
					(0.76)	(4.72)	(9.49)	(6.66)				
FID×ED					−0.0247	−0.1090***	−0.0873***	−0.1146***				
					(−0.71)	(−4.13)	(−9.42)	(−5.24)				
FIE									0.3124	0.1717	0.3732**	2.5739***
									(0.04)	(0.58)	(2.56)	(6.16)
FIE×ED									−0.0213	−0.0159	−0.0370***	−0.2391***
									(−0.05)	(−0.57)	(−2.66)	(−6.29)
COVID	−0.0004	−0.0022	−0.0105***	−0.0056	0.0004	−0.0060	−0.0135***	−0.0078	0.0005	−0.0009	−0.0108***	−0.0146**
	(−0.08)	(−0.41)	(−8.04)	(−0.95)	(0.07)	(−0.72)	(−7.79)	(−1.61)	(0.11)	(−0.17)	(−4.03)	(−2.17)
POP	0.0034***	0.0033***	0.0020***	0.0029***	0.0034***	0.0011	0.0012***	−0.0008	0.0032***	0.0031***	0.0008**	−0.0014
	(4.16)	(3.69)	(3.89)	(3.36)	(4.02)	(0.89)	(2.74)	(−0.52)	(3.85)	(3.52)	(2.17)	(−0.71)
GDP	0.0039	0.0023	0.0023	−0.0049	0.0039	−0.0042	0.0056***	−0.0060	0.0038	0.0028	0.0057***	−0.0025
	(1.18)	(0.65)	(1.58)	(−1.22)	(1.16)	(−0.90)	(3.68)	(−1.26)	(1.12)	(0.81)	(4.02)	(−0.62)
MOB	0.1795***	0.2117***	0.1102***	0.2027***	0.1831***	0.2631***	0.0638***	0.3034***	0.1900***	0.2121***	0.2250***	0.7196***
	(3.31)	(3.68)	(3.85)	(2.73)	(3.33)	(3.16)	(2.61)	(3.30)	(3.41)	(3.67)	(5.16)	(9.18)
Cons	2.8501***	2.8856***	3.5463***	3.2650***	2.8031***	2.8393***	3.5925***	2.7030***	2.7907***	2.7382***	2.8776***	−0.5101
	(10.61)	(10.60)	(28.46)	(11.36)	(10.69)	(8.02)	(30.40)	(6.46)	(8.83)	(8.38)	(12.27)	(−1.13)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
n	120	120	120	120	120	120	120	120	120	120	120	120
Adj. R^2	0.4756	0.4067		0.8108	0.4577	0.5966		0.6039	0.4519	0.4409		0.6201
Hausman		36.200***				2.58				45.61***		
P-value		0.0000				0.9208				0.0000		
Breusch and Pagan		49.16***				255.65***				257.39***		
P-value		0.0000				0.0000				0.0000		
Wald test	13.61***	86.86***	1516.25***	1053.02***	12.66***	139.62**	188.91**	878.3***	12.37***	73.64***	69.75***	142.73***

Dependent variable is life expectancy (LE). Pooled ordinary least squares regression (REG), fixed effect (FE), random effect (RE), feasible generalized least squares (GLS), and panel-corrected standard errors (PCSE). *t* statistics are in parentheses. *P<0.10, **P<0.05, and ***P<0.01.

Table 8: Oil-producing countries: Financial institutions' development and link between environmental degradation and human health

FID categories	Accessibility				Depth				Efficiency			
Estimation method	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
No. of column	FE	RE	GLS	PCSE	FE	RE	GLS	PCSE	FE	RE	GLS	PCSE
Dependent variable	LE	LE	LE	LE	LE	LE	LE	LE	LE	LE	LE	LE
ED	−0.0764***	−0.0067	−0.0249***	−0.0414***	−0.0706***	−0.0109***	−0.0141***	−0.0244***	0.0806***	−0.0117***	−0.0166***	−0.0280***
	(−6.09)	(−1.00)	(−5.58)	(−9.10)	(−5.45)	(−2.77)	(−10.87)	(−7.14)	(6.20)	(−5.08)	(−19.10)	(−7.64)
FIA	0.0281*	0.0134	0.0056	0.0218								
	(1.98)	(0.77)	(0.31)	(1.13)								
FIA×ED	0.0035***	0.0040***	0.0037**	0.0045***								
	(3.05)	(2.87)	(2.40)	(2.89)								
FID					0.0706***	−0.0109***	−0.0141***	−0.0244***				
					(5.45)	(−2.77)	(−10.87)	(−7.14)				
FID×ED					0.0632*	0.1674***	0.1279***	0.1789***				
					(1.84)	(4.60)	(12.08)	(4.35)				
FIE									0.0123	0.0224	0.0010	0.0290
									(0.50)	(0.82)	(0.27)	(0.97)
FIE×ED									−0.0012	−0.0002	−0.0017***	−0.0020
									(−0.69)	(−0.09)	(−6.27)	(−0.90)
COVID	−0.0186***	−0.0197***	−0.0225***	−0.0182***	−0.0155***	−0.0176***	−0.0200***	−0.0124***	−0.0160***	−0.0162***	−0.0204***	−0.0137**
	(−7.07)	(−6.00)	(−6.90)	(−4.48)	(−5.95)	(−5.27)	(−36.98)	(−2.91)	(−6.05)	(−5.74)	(−30.31)	(−2.52)
POP	0.0004	−0.0007	−0.0007	−0.0008	0.0018***	0.0018***	0.0013***	0.0033***	0.0005	0.0002	−0.0000	−0.0002
	(0.90)	(−1.25)	(−0.81)	(−1.10)	(3.43)	(2.77)	(4.73)	(4.28)	(1.10)	(0.32)	(−0.17)	(−0.20)
GDP	0.0040	0.0019	0.0070**	0.0219***	0.0043*	0.0071**	0.0090***	0.0221***	0.0046	0.0056**	0.0036***	0.0115***
	(1.47)	(0.59)	(2.05)	(5.03)	(1.66)	(2.33)	(8.79)	(5.22)	(1.65)	(2.07)	(8.54)	(3.27)
MOB	0.0299	0.0804	0.1131*	0.1100	0.0319	0.1036*	0.0984***	−0.0069	0.0577	0.1036**	0.0748***	0.0862
	(0.63)	(1.38)	(1.78)	(1.13)	(0.70)	(1.81)	(8.64)	(−0.06)	(1.18)	(2.53)	(7.66)	(1.17)
Cons	3.2047***	4.0045***	3.9326***	3.7469***	3.2347***	3.7849***	3.7996***	4.0538***	3.0169***	3.1681***	4.1272***	4.0254***
	(12.33)	(14.00)	(13.30)	(8.91)	(13.94)	(14.32)	(78.84)	(9.16)	(11.94)	(15.49)	(89.24)	(12.68)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	104	104	104	104	104	104	104	104	104	112	104	104
Adj R^2	0.5695	0.3536		0.6219	0.596	0.4148		0.7178	0.5242	0.5453		0.4986
Hausman		57.53***				24.77***				29.12***		
P-value		0.0000				0.0000				0.0001		
Breusch and Pagan		111.95***				99.39***				297.05***		
P-value		0.0000				0.0000				0.0000		
Wald test	16.82***	48.29***	100.44***	432.79***	18.76***	98.04***	4014.04***	1496.27***	14.00***	88.52***	2299.89***	556.21***

Dependent variable is life expectancy (LE). Pooled ordinary least squares regression (REG), fixed effects (FE), random effects (RE), feasible generalized least squares (GLS), and panel-corrected standard errors (PCSE). *t* statistics are in parentheses. *P<0.10, **P<0.05, and ***P<0.01

human health in oil-producing countries. This means that greater access to bank branches and ATMs and the availability of bank credit for the private sector could generate greater opportunities for green financing and investment and lower transaction costs, which reduces CO_2 emissions. Greater accessibility to financing in a country enables businesses, especially those in the automobile industry, to use more green bonds and green finance, which enables greater reduction in CO_2 emissions.

However, the efficiency of financial institutions shows no evidence of affecting the impact of environmental degradation on human health. This means that the efficiency of financial institutions in managing the net interest margin, the lending-deposits ratio, and the ratios of non-interest income to total income, overhead costs to total assets, and profitability do not influence environmental degradation in oil-producing countries. This result might be due to differences in the economic and demographic structure in these countries, which have large differences in population and economic functionality.

Our findings also result from differences in monetary policy by these countries. Unlike countries in the GCC region, where inflation rates are stable, Algeria, for example, is characterized by heavy stimulation to control the money supply to increase economic growth, with limited success in improving growth because of its heavy dependence on oil revenue for financing development projects, leading to growth rates that either stagnate or decline. Iran has limited involvement in international financial systems and lesser liberalization of its financial system, so the evidence of the efficiency of financial institutions is insignificant. In addition, the increase in inflation offers lessons on the viability of monetary policy management in which administrative controls and fiscal dominance are relying more on indirect liquidity management in compliance with sharia principles. An examination of the components of financial institutional development yields various results. However, financial development is generally a more influential tool for reducing the negative effect of environmental degradation on human health in oil-producing countries than in non–oil-producing countries.

5. CONCLUSION AND POLICY IMPLICATIONS

The study explores the role of financial institutional development on the relationship between environmental degradation and human health in the MENAT region (countries in the Middle East, North Africa, and Turkey). Using panel data analysis for 2009 and 2023, the paper argues that environmental degradation can enhance human health. Although countries in the MENAT region have greater environmental degradation (i.e., CO_2 emissions), people in these countries are expected to live longer because their governments increase expenditure on health care, enabling people to remain healthy. Although some MENAT countries have pollution and income inequality, human health is enhanced because the governments can afford adequate medical treatment and, at the same time, a reduction in income inequality.

The paper also reports that financial institutions' development (comprising depth, access, and efficiency) weakens the impact of ecological degradation on human health. This indicates that financial institutions enable greater engagement in new clean technologies and encourage green investment and financing; therefore, they have less environmental degradation. An increase in competition, which results from foreign capital inflows in the host countries, enables financial institutions to impose strict environmental standards or at least not tighten them, reducing the effect of ecological degradation on human health. In addition, financial institutions in developing countries may have slowly integrated ESG standards into their investment portfolios and occasionally encouraged environmentally and health-friendly projects because of a lack of regulations and political factors.

Our comparison of oil-producing and non–oil-producing countries shows that financial institutional development is an influential tool for controlling the effect of environmental degradation on human health. In oil-producing countries, financial institutions tend to significantly weaken the detrimental impact of environmental degradation on human health. However, in non–oil-producing countries, more developed financial institutions prevent some effects on human health due to environmental degradation. The differences in the results between these two groups might result from their differences in economic structure, the degree of economic development, and market efficiency. Unlike non–oil-producing countries, most oil-producing countries have well-developed financial institutions that are well integrated into global financial systems. Although oil-producing countries are likely to produce more CO_2 emissions, financial development helps them manage the health conditions of their population more efficiently than non–oil-producing countries; this is because the former have sufficient financial management capacities for supporting public health through the implementation of ecofriendly programs.

Several policy implications are offered by this work. First, these results offer valuable guidance to policy makers in emerging economies especially in the MENAT region. By relying on the results of this paper, policy makers can work toward promoting human health by adopting more effective environmental conservation programs associated with financial institutional development. Investors, especially those investing in clean energy and renewable energy sources, can benefit from our findings by paying more attention to their environmental conservation programs and people's future health. Reducing income inequality could raise average income, enabling people to spend more on their health care. The authorities can help raise the standard of living and access to health care by prioritizing regulatory standards for the environment and financial systems. Public authorities and governments are encouraged to invest more in health-care programs so that people can reap the benefits. Finally, policy makers could implement specific policies to reduce CO_2 emissions and discourage production of CO_2, specifically with a carbon tax, thereby enhancing human health.

The study has some limitations. The data used in this study on health, environmental pollution, and financial institutional

development varies across countries, so future studies could use a sample of MENAT countries with more homogenous data. For example, the GCC countries could form a sample together with other countries that have the same kind of economic and cultural structure. This might yield different results and confirm this study's findings. Furthermore, our study does not consider other factors that influence health, such as genetics, lifestyle, investor preferences, and socioeconomic factors, hence, a future study that takes these factors into account might obtain different results from ours.

Future research could also use other human health measures, such as access to health care, mortality rates, and health expenditures. It could also consider different research approaches, such as experimental or field studies to establish causality among human health, financial development, and environmental pollution. It would also be worthwhile to identify the impact of economic growth and environmental pollution on life expectancy based on specific policies or interventions related to health conditions. A time-series study could examine the long-run relationship among human health, environmental pollution, and financial development using cointegration techniques.

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