Impact of Ecological Footprint on the Longevity of Human Life: A Case of Emerging Asian Economies

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Abstract

The focus of this study is to explore the factors affecting life expectancy has been the focal of economics literature for both developed and developing countries. Among others, degradation in environmental quality has characterized differentiation in human life expectancy in different countries. People in developed countries like the United States of America and Japan live longer than people living in developing countries such as India, and Bangladesh. Therefore, the study in hand aims to explore the relationship between human life expectancy with ecological and environmental factors in emerging Asian countries. This study has utilized panel data from 2000 to 2019 for Bangladesh, China, India, Malaysia, the Republic of Korea, Singapore, and Thailand. The research emphasizes that human life expectancy is at risk under the consequences of rising ecological footprint and climate change in emerging Asian countries. The findings of the study serve the stakeholders and policymakers of emerging Asian economies and pave the sustainable path for other countries to follow to increase human life expectancy, not at the cost of ecological footprint.

Keywords: Ecological Footprint, Life Expectancy at Birth, Emerging Asian Economies, Infant Mortality, Environmental Degradation.

Introduction

Human life expectancy and well-being, the pivot of development, have depended upon many factors, including environmental quality along with social and economic factors (Deschenes & Greenstone, 2007). Economies around the world are struggling to increase the standard of living as well as per capita income, by using the earth's biocapacity to meet increasing population demand, to achieve economic growth along with other development goals. As far back as the anthropogenic activities caused by industrial revolutions e.g., power generation from fossil fuels continuously harming the earth's carrying capacity. This human impact on ecological services is referred to as an Ecological Footprint. Rising Ecological Footprint and environmental degradation due to anthropogenic stress on the ecosystem have characterized differentiation in life expectancy among many regions (Cutler, Deaton, & Muney, 2006).

The longevity of human life is found to be different in different countries even if countries are in the same region. Human life longevity is usually high in developed countries as compared to developing countries Chen et al., (2021). Chen et al., (2021) explored that in developed countries like America, life expectancy was grown up to 47 years from 1900 to 1977 while, in Japan, life expectancy was 77 years, On the other hand developing countries like the Republic of Africa life expectancy was 53 years only (Murray et al., 2013). His study explored the huge gap in countries' life expectancy at birth, reflecting differences in development patterns across the countries. Their research also reveals that developed countries like Japan import natural resources that are extracted by developing countries.

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Asia is the home of a 4.75 billion population that constitutes 60% of the world population share (WDI, 2020). Life expectancy at birth has significant importance in Asian countries where population density is high. These countries use traditional methods for the extraction of natural resources; moreover, in the production of goods, and in generating energy as well. The demand for goods and services as well as housing is increasing in Asia due to an increase in incomes and population demand which are driving more carbon emissions in Asia. It is found that carbon emissions have severe impacts on the environment, as well as on human health. The rise in carbon emissions is the main cause of the occurrence of various diseases like asthma, rhino sinusitis, and chronic obstructive pulmonary disease, which have reduced the longevity of human life in European countries (Balan et al., 2016). The rise in carbon emissions in developing countries is adversely affecting human health as well as life expectancy whereas a weak medical health system is exacerbating the situation (Word Health Organization, 2015; Pope, Royen, & Baker, 2002). These countries must increase their financial capacity along with other measures to reduce/mitigate carbon emissions to meet SDGs in the Asian region.

The temperature rise adversely affects human longevity of life in all ages (Seltenrich et al., 2015; Deschenes & Greenstone, 2007). It is investigated that the average temperature has a significant and negative effect on human health (Balan et al., 2016; Xu et al., 2014). Moreover, an unexpected temperature rise can accelerate the rising number of heat stroke occurrences, which can cause severe disorders or immediate human deaths (Gomes et al., 2015). The rise in the earth's temperature has brought multifaceted health problems including dehydration, respiratory problems, and infectious diseases (Gomes et al., 2015). The average temperature caused by infectious illnesses can lead to reduced human life expectancy and immediate deaths too (Gomes et al., 2015).

High-income countries are found to be more conscious about environmental quality and, therefore spend more money to improve environmental qualities as well as their health system. Domestic health expenditures per capita have positive impacts on human longevity of life (Bloom, Canning & Malaney, 2000). Efforts are being made in all developed and developing countries to enhance the health status of their citizens by increasing national health budgets and investing in health facilities. An analysis of health spending among countries shows that governments of developed countries spend more on citizens' health in various ways. These differences in health spending among developed and developing countries caused differentiation in life expectancy among countries. Generally, countries with lower health budgets face lower life expectancy and higher infant mortality rates (Erb et al., 2004).

A low level of health spending along with other social factors are found to be a cause of high infant mortality rates in developing countries (Sarkodie et al., 2019). The infant mortality rate can be referred to as the death of a child before his first birthday, it is measured by the number of infant deaths per 1,000 live births (NIH, 2021). The environmental and socio-economic factors affect infants' and mothers' health; furthermore, the effectiveness of national health systems is reflected in the decline in infant mortality rate. The historical decline in mortality rate is due to an increase in public health expenditures such as health facilities, as well as an increase in nutrition, along with an increasing rate of vaccination (Harris et al., 2010).

The study in hand explored the impact of the ecological footprint on life expectancy in the consequences of differences in human life expectancy in emerging Asian countries i.e. South Korea, Singapore, Thailand, China, Malaysia, Bangladesh, Vietnam, and India.

Countries-wise Life Expectancy Profile

Table 1 reveals the life expectancy in years of emerging Asian countries along with their worldwide

Table 1 Life Expectancy

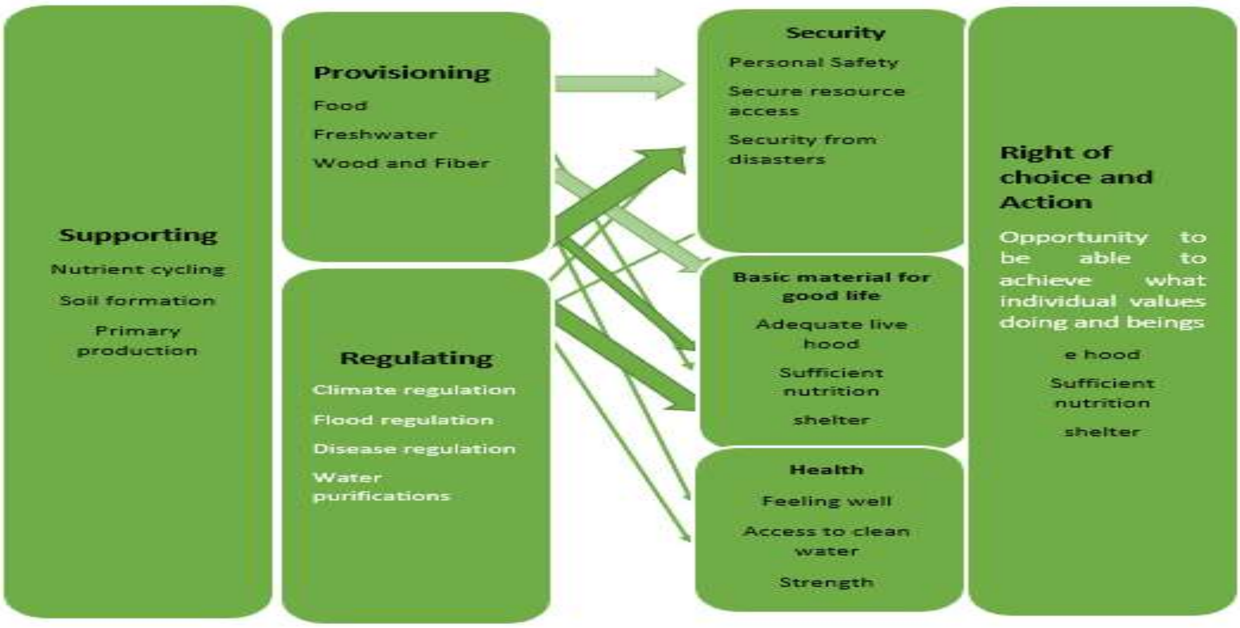
SR	Country	Life expectancy in years	World Bank Rank
1	South Korea	83.2	3
2	Singapore	83.1	4
3	Thailand	77.7	47
4	China	77	48
5	Malaysia	74	80
6	Bangladesh	74.3	85
7	Vietnam	73.3	92
8	India	70.8	117

Source: (World Bank. 2019).

Linkages of Ecosystem Services and Human Wellbeing

Figure 1 reveals the significant linkages among Human well-being and ecological and socio-economic factors.

Figure 1 Ecosystem Services Contribution to Human Well-Being



Source: Ecosystem and Human Well-Being: Wetlands and Water (2005).

Potential Mediation from Socioeconomic Factors and Human Well-Being **Strong Linkages of Ecosystem**

Weak
Medium
High

Poor
Weak
Strong

Research Objective

To examine the effects of ecological footprint on human longevity of life in emerging Asian economies.

To explore globalization's effects on the longevity of human life in emerging Asian economies.

Research Questions

Does ecological footprint affect the longevity of human life?

Does globalization affect human life expectancy?

Hypotheses

H1a Ecological footprint significantly affects human life expectancy.

H0a Ecological footprint does not affect human life expectancy.

H2a Globalization affects life expectancy.

H2a Globalization does not affect life expectancy.

Literature Review

Ecological sources provide goods and services, forest products, a clean environment, good health, and long life to human beings since the beginning of human civilization but the recent degradation in environmental quality has characterized differentiation in life expectancy among the regions. Ponts et al., (2010) investigated the relationship between ecological factors, macroeconomic factors, and human life expectancy, in their study, human life expectancy was used as a dependent variable. The results of this study revealed that ecological reserves, and industrial growth, are negatively correlated to human life expectancy. While, GDP growth, international trade, health care, ecological reserves, and population density have positive impacts on human life expectancy.

Dietz, Rosa, and York, (2009) examined the impact of natural capital, physical capital, and human capital on human life expectancy. Their study found that human capital and natural capital have positive impacts on human life expectancy in many developed countries. Zha et al., (2019) investigated the ecological factors' impact on human life expectancy. The study used detector methodology to analyze the relationship among variables, which was a combination of a factor detector, and ecological detector, as well as an interaction detector which represented a spatial analysis method, based on spatial stratified heterogeneity. Their study investigated that the life expectancy of Tibet residents had increased due to improvements in ecological conditions, environmental conditions, geological factors, along per capita incomes.

Rahman et al., (2022) investigated the factors affecting the longevity of human life. The study was conducted for the 31 most polluted countries in the world. Their study employed cross-sectional data from 18 years among different countries from 2000 to 2017. The statistical technique of this study was the Empirical-Based Preston curve model along with the panel, corrected standard errors, and feasible general least squares were applied to investigate long-run causality among variables of interest. Their study investigated whether carbon emissions have a direct or indirect effect on a person's health which reflects in his/her life expectancy, which results in the form of cardiovascular, and neurological systems, as well as the pulmonary system Moreover, it can lead to health concerns such as Asthma and lung inflammation as well (Pope, Royen, & Baker, 2002; WHO, 2015).

Watkiss et al., (2012) investigated several health effects caused by climate change on human mortality. This study used data from EU-27 countries in Europe. This study employed empirical as well as projected data from 2011-2040 and 2071-2100 and used data quantitatively method by using physical and monetary metrics. The study employed human mortality as a dependent variable. This study measured temperature as an independent variable. The temperature rise caused various diseases such as Salmonellosis infection which defined as a foodborne disease around coastal flooding was identified. The results showed mental health effects caused by climate change. Their study investigated that climate change can increase welfare costs up to 100 billion euros annually in the future time of 2071-2100.

Dutton et al., (2018) investigated the effects of health expenditures on health outcomes. The area of this study was Canada. The linear regression model was used for the analysis of data. This was an observational longitudinal study. The regression results showed that a one per cent health spending caused to decrease of 0.1% in avoidable mortality, as well as a 0.01% increase in life expectancy. Cutler, Deaton, and Muney (2006) investigated socio-economic and environmental factors that impact health outcomes. This study employed data from 1915 to 1939. The study revealed that there was a significant relationship between life expectancy and socioeconomic factors. The results of this study found that people in developed countries live longer as compared to people in less developed countries. This study revealed that pollution was found to be a key contributor to decreased longevity of human life and higher death rates.

Lelieveld et al., (2020) investigated the impact of anthropogenic stressors on human life expectancy. This study includes cross-sectional data from different countries. This study used the Global Exposure Mortality Model. (GEMM) for the analysis. In this study, human life expectancy at birth was used as the dependent variable. The independent variables of this study were major anthropogenic stressors like ambient air pollution and fossil fuel consumption. Their study revealed that life expectancy at birth can be increased on average by 2.9 (2.5-3.5) years by reducing potentially avoidable anthropogenic emissions, and life expectancy at birth can be raised by on average 1.1 (0.9-1.2) years due to reducing fossil fuel emissions only.

Song et al., (2016) investigated the relationship between environmental and socio-economic outcomes on health which were measured by life expectancy at birth. This study was conducted in 31 provinces in China. The dependent variable of this study was public health. The independent variables of this study were environmental factors along with socioeconomic factors. The study revealed that CO_2 and energy consumption adversely affected the longevity of human life, while GDP had a positive impact on human longevity of life in China.

Byaro et al., (2021) investigated the contribution of globalization to health outcomes. This study was carried out for Sub- Saharan African countries. The dependent variable of this study was life expectancy. The independent variables of this study were health expenditure, trade openness, and vitamin A supplement. The period of the study was 2000-2016. The generalized method of the moment (GMM) was used for the estimation. Their research explored that trade openness and measles vaccination reduced the under-five mortality rate in the region. The study indicates that trade openness, income, and health financing contribute to a longer life expectancy.

Majeed et al., (2018) investigated the quality of life and globalization in Islamic countries. The study used panel data analysis for 44 Islamic countries. The time of the study was from 1970 to 2010. The correlation matrix obtained, keeping other things constant globalization and quality of life are found to be directly associated with each other. Their study revealed that economic and political forms of globalization tend to improve the quality of life while social globalization does not improve the quality of life. Myrskyla et al., (2010) examined the impact of infant mortality on life expectancy. The focal area of this study was the United Kingdom. The results revealed that an increase in mortality between 1-5 ages was a cause of a decrease in human life expectancy from 5 to 30 years age. The literature supports the association of ecological footprint, average temperature and globalization. Literature also reveals that there is still a gap to find the association of ecological footprint, average temperature, and globalization with human life expectancy in emerging Asian economies.

Theoretical Framework

This section is based on the theoretical framework and the relationship of dependent variable human life expectancy with independent variables such as average temperature, carbon emissions, GDP, globalization, and Infant Mortality Rate (IMR). This study illustrates how ecological footprint, carbon emissions, and a rise in average temperature contribute to human longevity of life. The study focuses on the theoretical basis among variables and their connectivity using the theoretical underpinnings of the stochastic frontier model. The following sections explore the theoretical background of the study.

Human Ecology Theory

The human ecology theory holds that the human life quality and the quality of their environment are interdependent. This theory aims to study interactions among human beings and their social environment, physical environment, and biological environment. This concept is derived from ecology to social and environmental concerns. This theory was developed in 1920 by the Chicago School of Sociologists who derived concepts and analogies from ecology to organize theory as well as models for human society. The paradigm of human ecology considers environmental variables, and biological variables as synergistic ecosystems that affect human health. Human beings are facing numerous kinds of stressors on their health in their ecosystem simultaneously. The human conditions, wealth and technical attainment, risk of health issues, and nutritional and immunologic status. These factors are often used to measure the inequalities of society, and one can appreciate these factors that affect disease and health of people, moreover, ecological factors are combined with socioeconomic factors to capture the integrated impact of the factors of human life well-being.

Environmentally Efficient Well-Being (EWEB)

This research employed a model of efficient well-being (EWEB) which is inspired by a stochastic frontier theory commonly used in economics that was earlier proposed by Dietz, Rosa, and York, (2009). The EWEB model allows a nation or state to efficiently enhance human well-being by using economic, natural, and human resources. The EWEB model shifts countries' attention from traditional growth to sustainability and how they are efficient in producing human well-being by using natural physical and human resources. This model analyzed human well-being is measured by life expectancy along with natural capital, human capital, and physical capital. In this model, well-being is measured by life expectancy, anthropogenic activities such as ecological footprint climate factors such as average rise in temperature carbon emissions flow of physical capital, GDP, and socio-economic factors such as infant mortality, and health expenditure (Dietz, Rosa, & York, 2009).

Data and Source

The present study focuses on the empirical contribution of ecological footprint, carbon emissions, the rise in average temperature, GDP, Infant Mortality Rate (IMR), and health expenditure along with globalization as independent variables to measure life expectancy in emerging Asian economies such as Bangladesh, China, India, Malaysia, Republic of Korea, Singapore, and Thailand. To address the objectives of this study, the secondary data are obtained from World Development Indicators (WDI), the Ecological Footprint Network, the Climate Change Knowledge Portal, and the Swiss index of countries' globalization for the period of 2000-2019. The data is limited up to 2019 due to the non-availability of data. The following sections depict the variables of the study, their definitions, and their unit of measurement.

Functional Form of the Model

LE_{it}= Ғ (Carbon emissions, Ecological footprint, Average rise in temperature, Mortality rate, Globalization, Health expenditure, GDP)

Econometric Model

$LE_{it} = \beta_0 + \beta 1EFit + \beta 25CO2it + \beta_3 TEMP_{it} + \beta_4 GLOBit + \beta_5 HEA_{it} + \beta_6\ LGDPit + \beta_7 MOR_{it} + U_{it}$.

LE_{it} =Life expectancy at birth refers to the number of years a newborn is expected to live. It is measured by life expectancy at birth per 1000-person, dependent variable.

Average $Temp_{it}$ = Average yearly temperature at cross-section i and period are t used as an indicator of climate, independent variable.

EF_{it} = The Ecological footprint (EF) measures that, how fast a nation's population consumes resources and generates waste compared to how fast nature absorbs the waste of the population and generates new resources, the unit of measurement of ecological footprint is Global Hector (GHA) per person, independent variable.

CO_2= Carbon emissions measured in this study by Kt per capita, independent variable

GDP = Gross Domestic Product measures goods and services produced in a country in a year, which is measured by GDP, independent variable.

MOR_{it} = It measures the number of infant deaths before their first birthday. The infant mortality rate is measured by the "number of infant deaths for every 1,000 live births", independent variable.

Globalization = Globalization reflected how much the world is interconnected with trade and technology to each other. In this study, globalization is measured de facto and de Jure, independent variable.

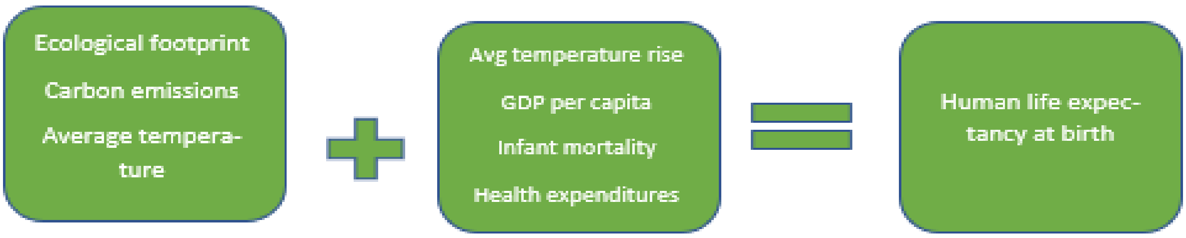
HEA_{it} = Health expenditures are the public spending on health by an individual in an economy, which is measured by domestic health expenditure per capita. This study incorporates health expenditures which reveals that have a positive influence on human life expectancy, independent variable.

Table 2 Description of Variables

Variables	Notations	Description	Proxy	Unit of measurement	Data source
	Dependent variable				
Life expectancy	LE	Life expectancy at birth refers average time expected to live	Life expectancy at birth	Life expectancy at birth per 1000	Word Development Indicators (2019)
	Independent Variables				
Ecological Footprint	EF	The Ecological Footprint refers to the impact per person or community on nature expressed as the GHA per person.	Ecological Footprint per person	Global hectares (GHA) per person	Global Footprint Network (2019)
Carbon emission	CO_2	CO_2 emissions	Carbon emission	CO_2 emissions KT per capita	World Development

			(kt per capita)		Indicators (2019)
Average Temperature	TEMP	Temperature is used as an indicator of climate change.	The Average Temperature	Average yearly rise in temperature	Climate Knowledge Portal (2019)
Globalization	GLOB	Measures how a nation is globalized with trade and technology using KOF Globalization Index constructs	KOF Index of Globalization is a composite index that ranges from 1 to 100.	KOF Globalization Index	KOF Globalization index (2019)
Health expenditure	HEA	Total domestic health expenditures per person at a particular time	Natural log of Domestic health expenditures per capita	Public health expenditure per person	World Development Indicators (2019)
Gross domestic product	LGDP	GDP is the value of all finished goods and services produced within a year.	Gross domestic product Current US$ in nominal prices	Gross domestic product Current US$	World Development Indicators (2019)
Infant mortality rate	MOR	Refers to the number of baby deaths before the first birthday in a particular population	Infant mortality	Death of an infant per 1000 before its first birthday.	World Development Indicators (2019)

Figure 2: Human Life Expectancy, Ecological Footprint and Socio-Economic Factors



Source: Developed by Researcher (Self-Authored).

This research has taken a set of emerging Asian economies into account to estimate the impact of climate change, ecological footprint, carbon emissions, and GDP on human life expectancy. Emerging Asian economies are facing significant climatic and socio-economic challenges with an increase in their GDP. The data dynamics are stationarity at the first difference, moreover, there is the presence of cross-sectional dependence, which revealed that the second-generation unit root test and FMOLS technique could be employed to measure long-run relationships among dependent and independent variables (Pedroni, 2001)**.**

Panel Data

This study has used longitudinal panel data from eight countries for 20 years. In this data, time is greater than the cross-sections.

Cross-Sectional Dependence

Panel data can be affected by extensive cross-sectional dependency, which occurs when all units in the same cross-section are correlated. This is usually ascribed to the influence of some unobserved common elements affecting each of them, though they may do so differently. The analysis of cross-sectional dependency is crucial, because of cross-interdependence among countries. If the panel data model contains a large time and a smaller number of countries, then the study should apply the cross-sectional dependence test Pesaran's., (2004). This study employed Pesaran's (2004) test based on a correlation matrix for panel data with a small time and many observations. The said equation is employed to test null the hypothesis of "no cross-sectional dependence.

$$CD = \frac{\sqrt{2T}}{N(N-1}\sum_{N=1}^{N-1} \quad \sum_{J=I+1}^{N} \quad Pit$$

(1)

Cross-sectional dependence between these two variables could indicate that the values of ecological footprint and life expectancy are not independent of each other within a given population, but instead may be influenced by other factors that affect both variables. One potential implication of cross-sectional dependence between ecological footprint and life expectancy is that it may lead to biased estimates of these two variables.

Hypotheses Testing

Following the identification of cointegration among the examined variables refers that Fully Modified Ordinary Least Squares (FMOLS) techniques have been used to estimate the long-run coefficients of the variables. Table 3 shows the KAO cointegration test. The probability value of KAO rejects the null hypothesis and accepts the alternative hypothesis, which is significant at 1%, 5%, and 10% significant levels.

Estimation Techniques

After verifying the cointegration test, the study moves toward the next step to estimate the coefficients of long-run parameters. In the presence of cointegration, the OLS estimators give biased results. Therefore, the study employed FMOLS for the estimation of long-run variables. FMOLS approach can eliminate the problems of big-size distortions brought on by endogeneity and heterogeneity dynamics of the following even in small sample cases. This technique has been used by Fatima et al., (2021) in their study to examine the ecological factors 'expectancy effects on human life expectancy.

Where:

ΔYt=α+∑i=1kβi(ΔXit−π^izt)+ϵt

Where:

ΔYt is a vector of differenced dependent variables.

ΔXit is a vector of differenced independent variables.

π^i is the estimated cointegrating vector for variable i.

zt is the error correction term (ECM).

α and βi are coefficients.

Table 3 shows the descriptive analysis of the study. The Jarque-Bera test checks the normality of residuals by considering the null hypothesis that residuals are not normally distributed. The results of Jarque-Bera depict that all the residuals are not normally distributed.

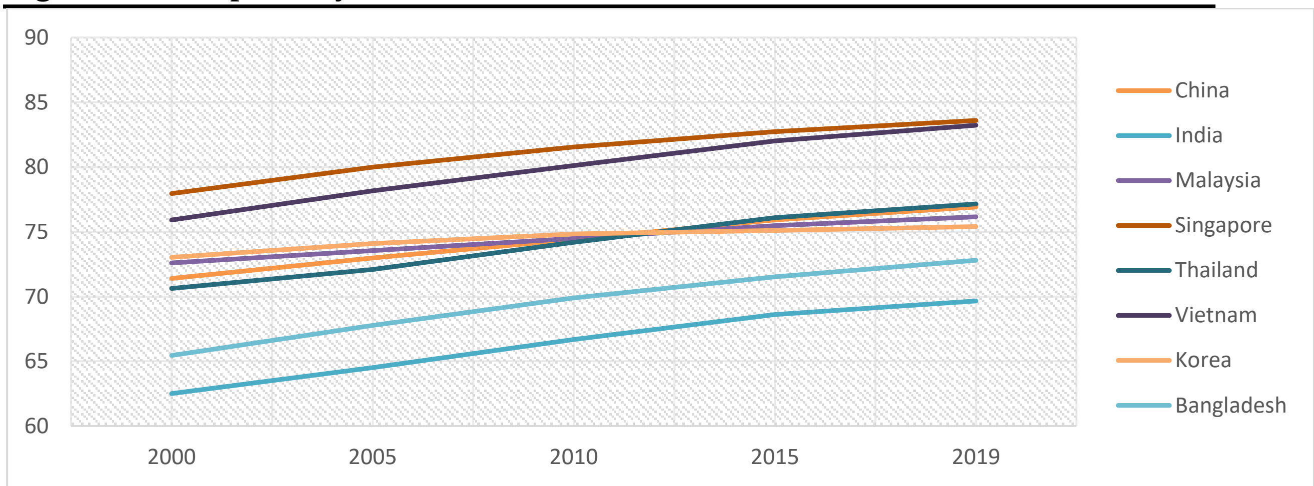
Table 3 Descriptive Statistics

	LE	CO2	EF	MOR	HEA	GDP	TEMP	LGLOB
Mean	4.304878	6.040296	0.434981	2.519432	1.702396	26.97064	3.10997	4.15628
Median	4.310578	6.973764	0.432986	2.598972	1.492703	26.48913	3.26537	4.16412
Maximum	4.425985	12.22525	1.843216	4.518522	4.409913	30.29102	3.33932	4.43509
Minimum	4.135247	0.169594	-1.18979	0.693147	0.406036	25.14768	1.95444	3.62396
Std. Dev.	0.066720	3.966278	0.873360	1.067311	0.938688	1.313382	0.40737	0.20207
Skewness	-0.34019	-0.04335	-0.11093	-0.05313	0.677810	0.847120	-2.2366	-0.59062
Kurtosis	2.791677	1.642230	1.873914	1.984605	2.720958	2.763342	6.08358	2.53744
Jarque-Bera	3.375463	12.34039	8.781969	6.948801	12.77047	19.50969	196.790	10.7285
Probability	0.018493	0.002091	0.012389	0.030980	0.001686	0.000058	0.00000	0.00468

Life Expectancy

This graph shows the human life expectancy of the emerging Asian economies, the graph shows intra-countries and regional differentiation in life expectancy. This differentiation among life expectancies in economies reflected changes in the socio-economic and ecological factors in these countries. Life expectancy in India is 69 years and life expectancy in Korea is higher at 83 years.

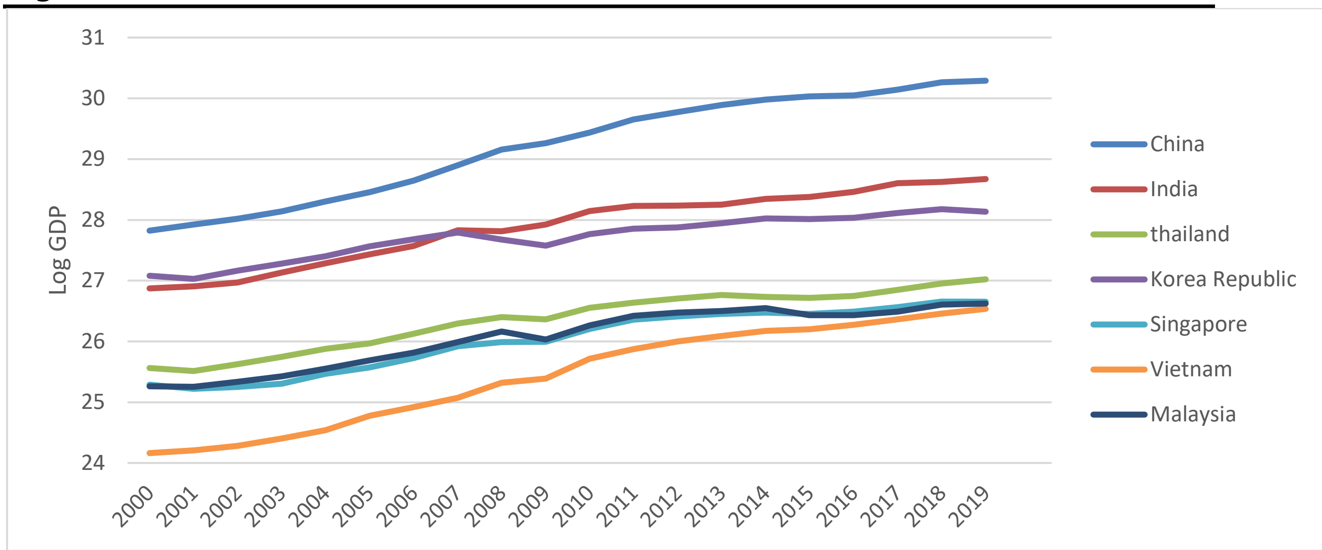
Figure 3 Life Expectancy



Gross Domestic Product

The graph shows 20 years trend for the real Gross Domestic Product in emerging Asian economies. The graph describes that GDP is higher in China among all emerging Asian economies, while lower in Bangladesh.

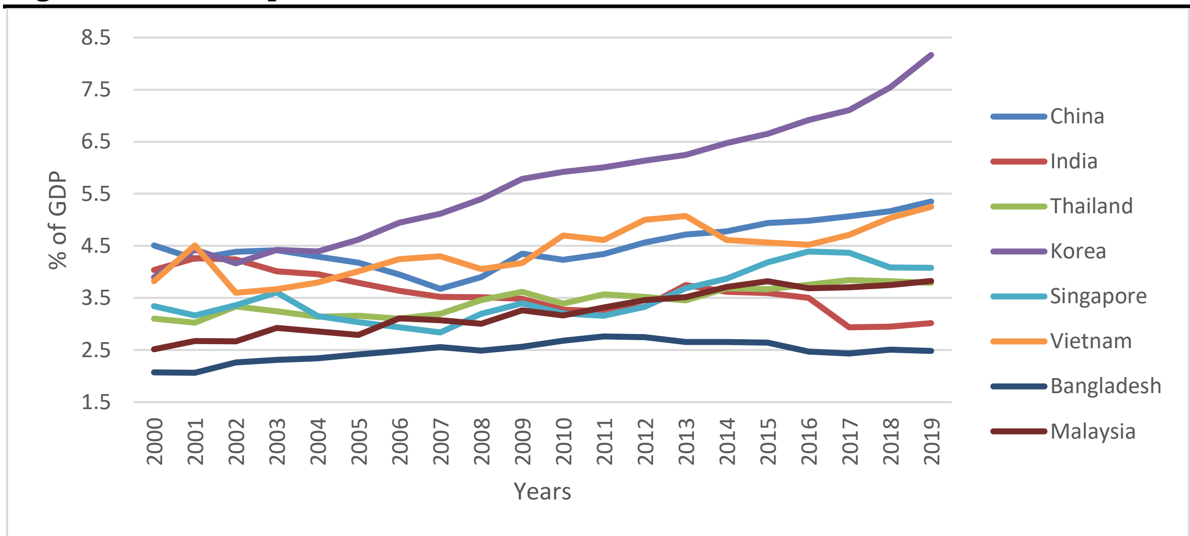
Figure 4 Gross Domestic Product



Government Health Spending

Health expenditures are an essential component of healthcare delivery systems. The health expenditures provide provisions for health services, nutrition programs, and health-related disasters. Countries that are spending more on health expenditures are having good health and more longevity of life.

Figure 5 Health Expenditures



Cross-Sectional Dependency

Cross-sectional dependence results are displayed in Table 3.3.2. To investigate the presence of CSD, the study used the Breusch-Pagan and Pesaran CD tests. Which reveals cross-sectional dependence exists in the data. To solve the problem of the CD, this study employed a second-generation unit root test (CASDF).

Table 4 Cross Sectional Dependence

Variable	Breusch-Pagan LM		Pesaran CD	
	Statistic	**Prob.**	**Statistic**	**Prob.**
LE	549.5472	0.0000	23.433	0.0000
EF	263.5546	0.0000	7.558	0.0000
CO_2	431.7489	0.0000	12.174	0.0000
Temp	193.2538	0.0000	10.43	0.0000
GLOB	465.4397	0.0000	21.441	0.0000
MOR	441.5326	0.0000	21.336	0.0000
HE	341.1512	0.0000	3.470	0.0000
LGDP	547.0917	0.0000	29.33759	0.0000

Unit Root Test

The unit root test has been employed based on the results of cross-sectional dependency. Table 4 shows the results of the Pesaran-CADF test. This test examined the stationarity of the data, these tests are divided into the 1st generation unit root test as well as 2nd the generation unit root test. Pesaran introduced the "second generation unit root test" Cross Section Augmented Dicky Fuller (CASDF). The 2nd generation unit root tests are more robust in response to cross-sectional dependency problems that provide exact results. The study employs a second-generation unit root test to investigate the data's stationary qualities. Due to the small p-value, the findings reveal that all series are non-stationary and exist at the level in both scenarios. However, at a 1% significance level, the series becomes stationarity at the first difference by rejecting the null hypothesis of non-stationarity series in both cases, such as without trend and with the trend, which refers that series is stationarity in the data at the first difference which is integrated of order one.

Table 5 PES-CADF Results

Variable	Statistics	P-value	Decision
LE	-6.938	0.000	1(1)
EF	-4.253	0.000	1(1)
CO_2	-2.999	0.001	1(1)
TEMP	-7.754	0.000	1(1)
HEA	-4.452	0.000	1(1)
MOR	0.230	0.021	1(1)
Glob	-4.978	0.000	1(1)
GDP	-1.937	0.026	1(1)

Cointegration KAO Test (1999)

The cointegration technique generally examines the long-run relationship among variables of the study, but all the cointegration techniques are not applicable in cross-sectional dependence. This study has used well known KAO (1999) cointegration test to investigate the long-run cointegration test, among variables. Co-integration test KAO indicates the presence of long-run relationships among the set of variables. The KAO (1999) cointegration test is employed based on a panel regression model. This test analyses the standardized cointegration coefficients with heterogenous intercepts.

Table 6 Cointegration KAO (1999)

	ADF
t-Statistic	-1.95086
Prob.	0.0255

The Fully Modified Ordinary Least Square Technique (FMOLS)

Hansen and Phillips applied the Fully Modified Ordinary Least Squares (FMOLS) model, for their research investigation in 1990. It employs a semi-parametric correction to address the issues that are impacted by long-run relationships, as well as the co-integrating equation and stochastic repressor innovations. The FMOLS Panel, as a result, is relatively unbiased. It also describes a fully functional estimator (Pedroni, 1999). FMOLS can also be used for data sets where time is greater than cross sections.

This study used FMOLS Techniques to estimate the data, the ecological services, which provide better food, fiber, forest products, and a healthy environment for a healthy life, the study in hand reveals that other things remain the same, a one percent increase in ecological footprint will decrease life expectancy by 0.021 percent in emerging Asian economies. (Ftima et al., 2021) also found a negative relationship between ecological footprint with human longevity of life.

Public health expenditures provide access to public health facilities at various levels which positively influences human health, the study in hand reveals that other things remain the same if a one percent increase in health expenditure would cause to increase in human life expectancy by 0.089 percent in emerging Asian economies under the face of better health facilities and access. Ftima et al., 2021) also found a positive relationship between average temperature with human longevity of life.

Carbon emission negatively influences human life expectancy, it causes various diseases in human beings such as Asthma, lung cancer, and respiratory diseases other things remain the same if a one percent increase in CO2 will decrease human life expectancy by 0.0098 percent. Dietz et al., 2011) also found a negative relationship between Carbon emission with human longevity of life.

Real Gross domestic products provide necessities to human beings which increase the standard of living of people. The study hand explores that if one percent increase in GDP will cause to increase in human life expectancy by 0.023 percent. (Song et al., 2016) also found a positive relationship between infant mortality with human longevity of life.

Infant mortality negatively influences human longevity of life, which reflects the number of deaths of children before their first birthday, it indicates the health level of a country. If mortality is increased by one percent, it will cause to decrease in human life expectancy by 0.061 percent. (Sarkodie et al., 2019) also found a negative relationship between infant mortality with human longevity of life.

The average temperature hurts human life expectancy, it causes various diseases such as waterborne diseases, allergies, vector-borne diseases, vector-borne diseases, other things remain the same if a one percent increase in temperature will decrease human life by 0.073 percent. (Ftima et al., 2021) also found a negative relationship between ecological footprint with human longevity of life.

Globalization refers to how trade and technology have made the world a more connected and interdependent place. Globalization also captures the scope of the economic and social changes, it influences positively human health, The study in hand reveals that other things remain the same if one unit increase in globalization will cause to increase in human life expectancy by 0.090 percent. However, the coefficient value of temperature is insignificant

due to the cancelling effects of a very high-temperature region with a lower-temperature region or country. (Byaro et al., 2021) also found a positive relationship between ecological footprint with human longevity of life.
The value of R-square is 0. 940058 which shows that 94 % of the variation in human longevity of life is explained by the model. The value of standard errors shows that the results of Fully Modified Ordinary Least Squares (FMOLS) are more robust.

Table 7

Variable	Coefficients	P-value
EF	-0.021527	0.0008
CO2	-0.009871	0.0000
Average TEMP	-0.073824	0.1762
GLOB	0.090722	0.0000
HEA	0.008918	0.0207
MOR	-0.061065	0.0000
LGDP	0.023964	0.0022
R-SQUARE	0.940058	
ADJ-R-SQUARE	0.939042	

Conclusion

Emerging Asian economies are facing the severe risk of a rise in ecological footprint and average temperature, these variables are driving climate change as well as environmental degradation to the quality across the globe. The research in hand evaluates the contribution of ecological footprint and the rise in average temperatures on human beings along with globalization with a well-defined measure of human life expectancy in emerging Asian economies such as Bangladesh, China, India, Malaysia, Republic of Korea, Singapore, and Thailand. The data obtained for these countries from 2000-2019 from eight emerging Asian economies. Human life expectancy has been used as the dependent variable however, ecological footprint, and the average temperature have been used as the independent variable while carbon emissions, GDP, health expenditures, infant mortality rate, and globalization have been employed for the estimation of the data.
The research in hand employed various tests such as cross-sectional dependence test, and unit root test as a pre-requisite of any problem. Results of cross-sectional dependence revealed that the problem of CSD exists in variables, therefore further estimation has been directed to the second-generation unit root test, which examines the stationarity in the variables. Pedroni, (2007) and KAO (1999) test of cointegrations has been employed to investigate the long-run relationship between variables. The Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) techniques have been employed for hypothesis testing and estimation of the data. The results indicate that ecological footprint and the average rise in temperature have a significant and negative impact on human life expectancy, which tends to reduce human welfare in emerging Asian economies. Ecological footprint and the average temperature adversely affect the environment in Asian economies. Human ecology theory and the stochastic frontier model support the findings of the model.
Secondly, ecological footprint and the average temperature caused to increase in diseases such as asthma, lung cancer, and heat stroke, and infectious diseases such as waterborne diseases, diarrhea, malaria, and dengue are identified, Furthermore, due to heatwaves there is an increasing trend of respirometry diseases, cardiovascular diseases have been found.

Globalization, GDP, and health expenditures have significant and positive influences on human longevity of life in emerging Asian economies, however, infant mortality rates have a significant and negative relationship with human longevity of life in emerging Asian economies. These variables are a significant determinant of life expectancy in emerging Asian economies. The statistical data for this study is extracted from different important sources such as the climate change knowledge portal, the KOF globalization index, and World Development Indicators, 2019.

Policy and Recommendation

Emerging Asian economies are facing multifaceted challenges, among others accelerating economic growth and sustainable development, increasing carbon emissions during development pursuits, increasing ecological footprint, providing health care services to their masses with constrained financial resources, adverse impacts of climate change, and tackling environmental deterioration.

Burning fossil fuels are the biggest source of carbon dioxide emissions, it may be in the form of vehicular pollution, producing electricity, and running industries. Continuous increases in carbon emissions are found to be negatively correlated with life expectancy in emerging Asian economies, it is needed to shift industries to efficient production methods from traditional and outdated methods of production, exploiting renewable sources for electricity generation. Policies and instruments should be devised and implemented to reduce vehicle pollution. There is a dire need to devise a mechanism to decarbonize major sectors of emerging Asian economies e.g., energy sectors.

In the absence of valuation of ecosystem services, these services are used free and wastefully thus leading to an increase in ecological footprint. Therefore, there is a need to develop markets for these services. The establishment of markets for ecosystem services can increase market-based incentives to use ecosystem services efficiently services as well as increase economic efficiency. The practice of reducing Ecological footprint as well as carbon emissions among regions and countries would have a positive impact on human well-being and longevity.

Life expectancy is found to be negatively related to Ecological footprint. Life expectancy can be increased by reducing the ecological footprint in emerging Asian economies therefore, it is needed to reduce pressure on the ecological footprint during economic development pursuits.

The temperature rise has proven to be a cause of various diseases along with reducing human longevity of life. Life expectancy can be increased by reducing local carbon emissions to reduce global emissions and adapting to increasing temperatures.

Life expectancy can be increased by improving public health systems as it is found to have a positive relation with human longevity of life. There is a dire need to increase public health expenditure and health sector efficiency (e.g., health insurance or other health schemes) to increase life expectancy in these countries.

It is imperative to devise policies to remove probable obstacles to increasing globalization (Tariffs and taxes) to increase the economic efficiency of human life expectancy in these economies.

Gap for Future Research

In emerging economies, there is a lack of information on the health effects caused by climate change. To have climate change health data there is a need to make an E-Health index at the national level which represents diseases caused by climate change to develop an effective policy accordingly.

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