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Interlinking Air Pollution, Economic Growth, and Government Health Expenditures: Evidence from South Asia

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ABSTRACT

Using environmental, economic, and demographic variables, this paper aims to reveal their effects on South Asian countries' public health expenditures during the period 2002 to 2020. Using the short-run and long-run coefficients obtained from the panel autoregressive distributed lag (ARDL) model, this paper analyzes the effect that variables like CO2 emission, GDP per capita, life expectancy, and the proportion of elderly people on government health expenditure. The analysis shows that CO2 emissions correlate positively with GDP per capita with public health expenditures showing the burden on the health budgets due to environmental pollution and development. On the other hand, an increased elderly population is characterized by a negative relation with health spending probably due to changed healthy living lifestyles. Life expectancy has a positive relationship with healthcare expenditures and all other variables have shown insignificant effects on expenditures or else any other variable. The research stresses the post-COVID-19 need for regulating air pollution, distributing economic resources efficiently, and developing more sustainable healthcare policies in South Asia. The outcomes of these analyses should assist policymakers in strategically addressing the conflict between environmental protection and economic growth, as well as investment in public health.

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1. Introduction

A strong economy is crucial for the integration of all aspects of nation-building. The success of the economic sector must align with social and ecological changes to improve people's health. CO2 emissions, housing adequacy, health, and education are four key indicators used to assess social progress. The burning of fossil fuels in industries causes carbon dioxide emissions. These emissions pose significant health risks, as high levels of CO2 drastically deteriorate air quality. The decline in air quality can lead to various health issues, increasing the demand for medical care. As a result of the increased demand for medical services, state spending in this area will be on the rise. The destruction of the environment has led to a deterioration in overall health and an increase in healthcare costs. Thus, national development encompasses not only the aspiration for economic prosperity (that is, maximum income) but also the improvement of ecological standards. Both the expansion process and personnel management are important. Economic growth can lead to a deterioration of the state of the environment and an increase in health expenses. The cost of public health is influenced by numerous factors. Moore (2006) investigated the relationship between per capita income, life expectancy, and infant mortality rates from a health perspective. According to research, public finances have very little influence on government spending in the health sector. Another important element is the evolution of the healthcare system, which has led to changes in life expectancy and infant mortality rates.

Samadi and Rad (2013) suggested that gross income per capita has strong effect on government expenditures. It also indicated an adverse relationship between public spending and the proportion of the elderly population. This is the kind of phenomenon that can explain how the presence of people with good health conditions rather than poor health conditions, reducing the demand for medical services, has been discovered among people living in countries where economies are cooperative (ECO). In a national statistical study of CO2 emissions, birth rates, inflation, per capita income, and life expectancy, Boachie and Ramu (2016) tried to find out how these impact on public health expenditure. The results of the research showed that income, expectations, and birth rates are the most important predictors of how much a country spends on health. The positive effects of CO2 emissions and inflation are not deemed significant. Abdullah, Azam and Zakariya (2016) investigated the impact of economic, demographic, and environmental factors on government health spending in Malaysia. Finally, according to their conclusions, companies spend a great deal of money rejecting atmospheric pollutants like CO2, SO2, and NO2. In a study by Chang (2023) about the impact of financial income, carbon dioxide (CO2), and aerosol particles they found results of equivalence. (PM10). According to their results, the main drivers of public spending are individual income and CO2 levels.

In recent decades, environmental preservation and climate change have become increasingly important. The main driver of climate change is the increase in carbon dioxide (CO2) emissions and other greenhouse gases. Environmental scientists unanimously recognize that carbon dioxide (CO2) emissions play an important role in the phenomenon of global warming, primarily due to the greenhouse effect (Suryasa et al.). CO2 emissions have a huge negative impact on the climate and cause serious health problems in humans. The aforementioned variables make the climate extremely sensitive and contribute to environmental degradation (Mohsin et al., 2019). This problem arises from the negative impact of polluted air on human and environmental health. According to Jerrett et al. (2005), these nations have prioritized reducing the resources allocated for health to invest more in improving the environment. Significant changes in the economic environment can impact households' health costs. Industrial pollution in China has exerted enormous economic pressure on the country's household expenditures. (2019), and Yang and Zhang (2018) conducted a study that demonstrated an increase in healthcare expenditures in 31 Chinese cities due to industrial pollution. Sabina et al. (2020) reported a decline in life expectancy by 100,000 years and an economic cost of 3 billion dollars. Moreover, researchers found that healthcare spending affects economic growth forecasts, particularly gross domestic product (Vyas, Mehta, & Sharma, 2023). (PIB). From 1995 to 2009, Fan and Savedoff (2014), as well as (Liang & Mirelman, 2014), conducted in-depth assessments of the relationship between revenue mobilization and government spending on healthcare in 126 countries. Moreover, an in-depth study of 89 countries from 1995 to 2011 revealed a significant connection between government tax revenues and healthcare spending (Reeves et al., 2015).

Enforcement of air quality has emerged as an important socio-political question across South Asian countries; public health and strategies of health care bog down drastically due to air pollution. India for instance, with 93% of its people breathing air poor for health, has an air pollution index that is 6.5 times worse than WHO standards (Institute for Health Effects, 2022). The country is among the five most polluted countries in the world with Egypt, Pakistan, Bangladesh, and Nigeria coming right after the country (World Air Report, 2020). However, the quality of the air has been declining through the improvement of industrialization and urbanization which increase the level of CO2 in the region notably. Increasingly, various forms of air pollution affect public health greatly leading to high incidences of diseases like COPD, cardiovascular diseases, and various respiratory illnesses, which put a lot of pressure on the health systems. Thus, as the problem of air pollution most heavily affects populated regions, and, in the case of South Asia, consequently aggravates the death rate due to associated diseases, healthcare expenditures in this area remain relatively low. For instance, in India, the average per capita expenditure on health is $83, which is around 5 percent of the Government of India budget (Institute for Health Effects, 2022). Nonetheless, a considerable part of the expenditure is paid directly by patients and overall out-of-pocket costs exceed governmental spending on health. Such inequalities in healthcare funding combined with pollution cost India approximately 8.5% of its Gross Domestic Product (GDP) which worsens the healthcare challenges (World Air Report, 2020). The following gaps are crucial for refining the knowledge of the connections between CO2 emissions and healthcare funding in the region: there are more and more expensive diseases caused by air pollution; however, there is a significant shortage of funding for healthcare in this region. This research seeks to look at the impact of carbon dioxide

emissions on health expenditures in South Asia to analyze the extent to which increased CO2 emissions, a major cause of air pollution, affect health expenditures. Since air pollution is ranked the fourth main cause of death in the world and has recently become the leading cause of death ahead of the accident, it is important to understand this dependence and its further development for the formation of policy measures. Since according to the Institute for Health Effects, PM2.5 levels are expected to double by 2050 compared to the levels recorded in 2015, this paper aims to measure the effects of healthcare expenditure implications affecting the South Asian region and establish policy interventions that address environmental and health repercussions of air quality.

2. Literature Review

Wagner's thesis of 1890 documented an increase in public spending relative to GDP in European countries, the United States, and Japan, highlighting the growing importance of government activities. According to Wagner's law, when per capita income increases, state expenditures also rise. The levels of state income and advancements in medical research determine the allocation of public funds in the healthcare sector, as evidenced by existing empirical data on life expectancy and infant mortality. Like Yap and Selvaratnam (2018) and Mumba (2020), the authors also carried out empirical work based on a dataset for 12 Asian countries. According to their results, the most important aspects determining state spending on health are economic indicators in society and the number of elderly citizens. Per capita income, proportion of elderly people in the population and transfer income are the key factors leading to a variation in public spending in health sector. As shown in De la Maisonneuve and Oliveira Martins (2013) and in Lubitz et al. (2003), for instance, the link between public health spending and the elderly is stronger than between municipal revenues or information on life expectancy. According to Wagner’s dissertation of 1890, the state expenditure as a share of the GDP has increased in European countries, in the USA, and Japan, showing the increasing role of the government in civic life. The Wagner Law, however, states that income per capita will also increase government outlays. The distribution of public funds in healthcare is shown by existing empirical data on life expectancy and child mortality to depend on the level of government revenue and achievement in medical research. There is another empirical study based on a dataset from 12 Asian countries done by Mumba (2020) and Yap and Selvaratnam (2018) which investigated the main factors contributing to government spending in healthcare, according to their findings, the economic and social indicator like number of elderly people, per capita income, the portion of elderly people in the population, and transfer income are the main variables for government spending in the healthcare sector. Two separate studies conducted by Di Matteo and Di Matteo (1998) and (Nunes & Nunes, 2024) showed a stronger connection between government spending on healthcare and the elderly population than with municipal revenues or statistics on life expectancy.

The rise in air pollution levels in certain regions of China has led to a significant increase in household spending on air purification equipment. Exposure to air pollution leads to higher medical costs, according to a study covering 110,700 urban families in China. Zhang and Zhang (2024) found a strong link between higher levels of exposure to pollution and increased health costs for households. The increase in carbon dioxide emissions has led to a rise in health costs in fourteen countries in Latin America and the Caribbean. This work has used a panel regression analysis to determine the dynamic relationship between health expenditure, high-tech exports, agriculture, and carbon dioxide emissions. The study by Toplicianu and Toplicianu (2014) examined the relationship between environmental degradation and health expenditures and found a clear link between higher levels of human capital and both labor productivity and economic growth. Furthermore, economic development improves both living standards and health. However, this deteriorates the environmental conditions, which causes dangerous health effects and, ultimately, an increase in healthcare costs. According to Preker and Carrin (2004), health costs worldwide varied between 630 billion and 240 billion dollars, which corresponded to between 3% and 9% of total health costs globally. By excluding high-income countries, diseases related to pollution account for more than 14% of global health expenditures. This burden disproportionately affects the segment of the population with the lowest incomes. As a result of this, the increase in environmental pollution has both negative and positive consequences for health. This makes it possible to spend more on health and reallocate more resources for better environment for better quality. As a result, we require further empirical study to describe accurately the relationship between environmental pollution and health care costs. In 19

countries of the Eastern Mediterranean region of the WHO, the economic crisis had a great effect on health spending between 2005 and 2013. This period witnessed a fall in the rate of unemployment, personal spending and health resources of various nations which were the key factors in determining health expenditure (Pourmohammadi et al., 2018). The researchers have also looked at the gross domestic product (GDP) and health spending in OECD countries. The disparities in health spending have been observed by them and they have found that 92 percent of such disparities in health spending were accounted for by the GDP of OECD nations (Devlin & Hansen, 2001). In order to assess the causal association between health spending and economic development, Stepovic (2019) reviewed the existing studies and revealed that, although economic growth reduces health spending, higher health spending leads to greater growth. Researchers conducted an empirical study in Russia and the Czech Republic, which revealed a mutually beneficial cause-and-effect relationship between health spending and economic growth. Furthermore, empirical evidence from Egypt, Hungary, South Korea, South Africa, and the Philippines supports the idea that health objectives take precedence over financial considerations. However, data from Greece, Poland, the United Arab Emirates, China, and Indonesia reveal the widespread presence of "excessive health," primarily due to financial considerations .

The correlation between healthcare spending per capita and income levels indicates that income plays a key role when comparing healthcare expenditures between countries. (Bedir, 2016). The mutual correlations between healthcare spending and economic growth in MENA countries from 1995 to 2015 demonstrate the paramount importance of the healthcare sector in Arab countries (Balkhi, Alshayban, & Alotaibi, 2021). A comparative analysis of the countries of the Gulf Cooperation Council that do not participate in oil exports, conducted from 1995 to 2012, showed results similar to those obtained in other countries (AlSaied & AlAli, 2021). The data from 20 OECD countries, covering the periods from 1960 to 1987 and from 1971 to 2004, confirm these findings (Baltagi & Moscone, 2010; Blomqvist & Carter, 1997; Gerdtham et al., 1992). A study of 21 Indian states from 1980 to 2014 showed that government funding and healthcare financing had a significant impact on both economic growth and healthcare expenditures (Behera & Dash, 2018). According to this study, excessive indebtedness to finance healthcare and insufficient mobilization of resources increase economic burdens and hinder economic growth.

Scientists have discovered a bidirectional relationship between carbon dioxide (CO2) emissions, healthcare spending, and GDP per capita. At the same time, they found a one-sided causal relationship between healthcare spending and GDP per capita. The analysis of healthcare expenditures confirmed that this was correct. The destruction of the environment and inadequate health conditions negatively impact production efficiency, slowing down the growth of developing countries. (2023) reported that more affluent countries dedicate a majority of their resources to healthcare and pollution control systems. Economic growth occurs when financial resources are distributed to provide medical care and pollution management services according to (Li, Lin, & Chiu, 2020). The research by Chaabouni and Saidi (2017) revealed that CO2 emissions, economic growth and healthcare spending create a positive connection among themselves. The authors applied Generalized Method of Moments for analyzing their simultaneous equation models. (GMM). The study established CO2 related to HE as a one-way causal link while showing both directions of causation in connections between CO2 and GDP and between healthcare spending and GDP. The research conducted by Chaabouni and Saidi (2017) using data from 51 countries validated that health stands more important than economic development. Researchers evaluated the patterns of gross domestic product and carbon dioxide (CO2) emissions per capita and healthcare expenditures over sixteen years in forty-two nations of Sub-Saharan Africa between 1995 and 2011. Evidence indicates that GDP and carbon dioxide emissions and healthcare costs form one-directional causal connections throughout short-term analysis. The analysis established permanent connections between carbon dioxide releases and healthcare spending over time. Studies by Apergis et al. (2018) establish that greater healthcare costs create reductions in carbon dioxide emissions.

3. Model, Data, and Methods

3.1. Model

This research uses annual records spanning from 2002 to 2020 to investigate whether environmental quality influences public health expenditures (PHE) in Central Asia. The study uses health expenditure (HE) as the metric for total healthcare costs and gross domestic product (GDP) as the measure of economic expansion. Nitrogen dioxide (NO2) serves as one of the environmental variables together with various greenhouse gases. The measurement unit for

greenhouse gas emissions uses kilograms of Carbon dioxide equivalent. WDI provided the research data for this study together with two variables. Fertility rate (FR) represents the average childbearing capability of a woman throughout her life but the infant mortality rate (IMR) measures death cases during infancy in relation to 1000 live births. The dataset provides information on methane emission from the energy sector which is presented in thousands of metric tons equivalent to CO2. The included variables provide necessary demographic and environmental information through a single-time analysis to investigate healthcare costs in Central Asia. All the variables of the model are first taken in natural logarithm to aid elasticity analysis. The primary model is structured as follows:

$$lnPHE_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 lnPHE_{t-i} + \sum_{i=0}^{q_1} \beta_1 lnGDP_{t-i} + \sum_{i=0}^{q_2} \beta_2 lnCO2_{t-i} + \sum_{i=0}^{q_3} \beta_3 lnAAH_{t-i} + \sum_{i=0}^{q_4} \beta_4 lnPOP65_{t-i} + \lambda ECM_{t-1} + \varepsilon_t \quad (1)$$

PHE_t = represents health expenditures at time t.
GDP_t = gross domestic product per capita.
$CO2_t$ = denotes the carbon dioxide emissions in metric tons per capita.
AAH_t = shows life expectancy (years).
$POP65_t$ = represents the Number of elderly people (residents).
MR_t = denotes foreign direct investment, net inflows as a percentage of GDP.

ECM_t = is the error term, capturing the unobserved factors that may affect health expenditures. We employ the ARDL model to evaluate short-run and long-run co-integration relationships among environmental quality data along with life expectancy and number of elderly people and public health expenditure in South Asia from 2002 to 2020. The ARDL model specified by Pesaran and Shin (1999) provides researchers with the ability to estimate error corrections through its specification despite requiring no pre-testing of variable stationarity. The technique achieves its most crucial application when analyzing data across multiple periods which includes variables at diverse integration levels. Before applying the ARDL technique, which is done instead of the error correction model (ECM), we follow the ADF test to ensure that the chosen variables are stationary. From a general point of view, ADF test permits one to choose a number of unit roots in each variable so that its risk of spurious regression is minimized. The other case is when p value is greater than 0.05, therefore we accept the null hypothesis which specifies the unit root of the variable in words. Thus, the variable is said to be stationary if the p value is less than 0.05. After stationarity tests, we utilize ARDL bounds testing procedure to see if there is interaction between the variables. In addition, the ARDL model in our study is appropriate for describing the long-term equilibrium relationship in which we can account for the lagged levels and the first difference of the variables of our interest (CO2, AAH, POP65) and the government health expenditures (PHE). The findings of ARDL facilitate the study of the short run and long run steady state association between environmental quality and public health expenditure in South Asia.

4. Results and Discussion

This section reports the empirical results on the relationships between the government health expenditure (PHE), air pollution (CO_2 emissions), economic growth (GDP per capita), life expectancy (AHH) and the elderly population (Pop65) in South Asia. The stationarity in this panel data is analyzed first by means of panel unit root test and then by cross section dependence test to check the correlation in this panel data. Consequently, the short and long run effects of the economic and environmental factors on healthcare spending are examined based on ARDL long run estimation results.

Table 1: Descriptive statistics

Variables	Mean	Median	Maxi	Mini	Std.Dev	Obs
PHE	4.479668	3.661538	15.53361	2.140169	2.725377	133
CO2	0.487722	0.409288	1.131310	0.154976	0.270078	133
GDP	1483.407	1150.672	4495.710	354.0337	997.0201	133
AHH	67.25177	67.09100	76.39300	56.45400	4.133249	133
Pop65	4.936765	4.737673	10.80298	2.288834	1.805258	133

The descriptive statistics of the key variable used in this study, including PHE, CO_2, GDP, AHH and the proportion of elderly population (Pop65) of South Asian countries from 2002 to 2020 are presented in Table 1. The required average public health expenditure is 4.48% of GDP, which equals 3.66% on a median of the mean (moderate spending by the governments in the healthcare). But the variation over the range of 2.14% (minimum) to 15.53% (maximum), and standard deviation of 2.72, suggest large disparities among countries, for, depending on the economic capacity and healthcare priorities, there are big differences between countries. CO_2 emissions have a mean value of 0.49 metric tons per capita, with a relatively small standard deviation of 0.27, indicating moderate variation across the region. The highest recorded emission is 1.13 metric tons per capita, suggesting that industrial activity and environmental pollution levels vary significantly. GDP per capita exhibits the highest dispersion among all variables, with a mean of $1483.41, a minimum of $354.03, and a maximum of $4495.71, along with a high standard deviation of 997.02, emphasizing the economic disparity within the region. Life expectancy, represented by AHH, averages 67.25 years, with moderate variation across countries, ranging from 56.45 to 76.39 years. The proportion of the elderly population has a mean value of 4.94%, with a maximum of 10.80% and a minimum of 2.29%, suggesting a relatively young demographic in most South Asian countries. Overall, the descriptive statistics indicate significant differences in economic strength, pollution levels, and healthcare investments across South Asia, justifying the need for further econometric analysis to explore the interactions between these variables.

Table 2: Penal Unit Root Test (LLC)

Variables	Level	1st DIF Stat (prob)	Decision
Co2	0.14954 (0.5594)	1.63114 (0.0514)	1(1)
Life expectancy	-4.00966 (0.0000)		1(0)
Pop65	-1.88072 0.0300		1(0)
Health Exp	0.63057 (0.7358)	-1.37932 (0.0839)	(1)
GDP	-1.91946 (0.0275)		1(0)

The panel unit root test (LLC) results in Table 2 determine the stationarity of the variables, which is crucial for selecting the appropriate econometric model (Levin, Lin, & James Chu, 2002). This test is carried out both at the level and at first differencing to ascertain if each variable is integer I(0) (stationary at level) or I(1) (stationary after first differencing). The results show that life expectancy (AHH), percentage of population aged 65 (Pop65) and GDP (GDP) are not trending at level I(0) and do not need differencing. However, CO_2 emissions and health expenditure (PHE) are non stationary at level while they are stationary with first difference I(1), which implies that there exists the unit root. The mixed integration orders validate that the ARDL model is an appropriate estimation method for the identification of the long and short run relationship among the variables (Pesaran & Shin, 1999). This is because most variables are stationary at I(0) such that spurious regression is absent and I(1) variables are suitable for co integration testing, confirming the use of ARDL for further analysis (Nkoro & Uko, 2016).

Table 3 Cross-section Dependence tests

Variable	**Test**	**Statistics**	**D.f**	**probability**
Health expenditure	Breusch-Pagan LM	182.5263	21	0.0000
	Pesaran scaled LM	23.84392		0.0000
	Pesaran CD	11.61187		0.0000

Table 3 confirms the presence of cross-section dependence among the variables of the panel data. The p values of these tests are 0.0000 which are statistically significant, hence, we have evidence of cross-sectional dependence of health expenditure among South Asian Countries. This implies that shocks or policy changes in one country have a big impact on other countries in the region, most probably because they share common economic and environmental factors as trade policies, regional economic integration and shared environmental challenges (Pesaran, 2004). When there is the presence of cross-sectional dependence, it is necessary to use econometric techniques which take into account these interdependencies in order not to arrive at biased estimates. However, heterogeneity across countries can be accommodated in the ARDL model and it captures both short and long run relationships (Chudik & Pesaran, 2015).

However, if cross-sectional dependence is strong they can improve robustness of the findings (De Hoyos & Sarafidis, 2006). The results thus highlight the interlinked nature of public health spending in South Asia and the necessity to coordinate regional policy as an approach to the battle against healthcare challenges.

Table 4: ARDL Estimation Long Run Result

Dependent variable: Government Health Expenditure (PHE)

Variable	Co-efficient	Standard error	t-statistics	P-value
AHH	0.080914	0.066314	1.220158	0.2267
POP65	-3.112047	0.888222	3.503683	0.0008
GDP	4.242859	1.344121	3.156604	0.0024
CO2	3.455876	1.485212	2.326856	0.0231

The ARDL estimation results in Table 4 yield valuable long run results of the relationship between government health expenditure (PHE) and its determinants in South Asia. Life expectancy (AHH), the proportion of elderly people (POP65), GDP (GDP) and CO_2 (CO_2) are found to influence the public health expenditure differently, consistent with the literature. The coefficient for life expectancy (AHH) is 0.0809, which is positive but statistically insignificant (p-value = 0.2267). This is consistent with Boachie and Ramu (2016) and (Toplicianu & Toplicianu, 2014) that life expectancy has an effect on health spending, but one that is overshadowed by other factors, associated with economic development or demographic changes. However, the insignificance of the result here indicates that other macroeconomic and environmental factors dominate the influence on public health spending. Government health expenditures are affected in a negative and highly significant (p-value = 0.0008) by the proportion in the elderly population (POP65). This is also in agreement with (Samadi & Rad, 2013) and Samadi (2013) and Di Matteo and Di Matteo (1998) who showed that an aging population can lower government healthcare spending since healthier living conditions and a reliance on private healthcare increase. Moreover, this result contrasts with studies from developed economies where aging populations typically drive up healthcare costs (Lubitz et al., 2003). In the South Asian context, this negative relationship may reflect lower government investment in elderly care services, reliance on family-based support systems, or limited public healthcare coverage for senior citizens.

GDP per capita has a strong positive and significant impact (4.242, p-value = 0.0024) on government health expenditures, indicating that economic growth significantly boosts healthcare spending. This is consistent with (Sedrakyan & Varela-Candamio, 2019) that the higher the country's income, the higher the proportion of its government spending on health, supports. As Reeves et al. (2015) and Mumba (2020) and have reported, the higher is the income level, the higher is the investment in public health infrastructure, medical technology and healthcare access. This is in keeping with the charge that economic growth enhances healthcare financing and that governments can therefore put more funds behind public health programs. In line with studies that show how environmental pollution puts a burden on healthcare spending, CO_2 emissions have a positive and statistically significant impact (3.455, P value = 0.0231) on health expenditures. The results are in line with Abdullah, Azam and Zakariya (2016) and Chaabouni and Saidi (2017) who show that rising CO_2 emissions increase government healthcare spending as a result of pollution induced diseases such as respiratory diseases, cardiovascular conditions and chronic lung disorders. This also agrees with (Sabina et al., 2020) and (Zeng & He, 2019) that industrial pollution hurts people's welfare greatly, especially in countries where environmental regulations were not strictly enforced, such as developing economies. These findings indicate the close relationship between economic growth, environmental degradation and demographic changes with healthcare expenditure. Economic prosperity increases public health financing whereas air pollution is becoming a growing financial burden on government budgets. The steps taken to address the demographic challenge of the aging population in South Asia, through the issue of health spending, are not sufficient enough and thus the negative effect on the health spending also renders the public healthcare policies insufficient. These results reaffirm the importance of advancing sustainable economic policies, reinforcing environmental laws, and enhancing healthcare funding mechanisms that integrate economic growth with environmental sustainability and public health goals. Future research should develop policy frameworks which reduce pollution related health costs while ensuring equitable access to health care to all age groups.

5. Conclusion and Policy Recommendations

The ARDL model is used to investigate the relation between government health expenditure, economic growth, air pollution and demographic factors in South Asia. The study shows that higher GDP per capita positively affects healthcare spending, meaning that higher GDP per capita enables governments to allocate more resources to public health. Furthermore, CO_2 emissions, cause health expenditure to rise in an additional way, as elevated CO_2 emissions contribute to higher health costs caused by the pollution-imposed diseases. The results also indicate that government health spending does not depend much on life expectancy but does reflect the negative effects of the proportion of the elderly population, which may signal an inadequate support for the elderly in the healthcare area. The significance of these findings lies in the fact that economic development is interdependent with environmental sustainability and healthcare financing in South Asia. With these findings, one would suggest policymakers add more to public healthcare spending from growth driven revenues in order to increase accessibility and quality in the public healthcare system. To alleviate the health expenditure burden of pollution, governments should introduce stricter environmental regulations, promote renewable energy sources and carbon tax policy. The second point is that an aging population is not only negative for welfare state spending in general, but also for healthcare spending, insofar as the need for long term elderly care policies, pension-based healthcare support and investment in preventive healthcare measures will arise. To ensure a healthier and sustainable future for South Asia, it is of essence to adopt a balanced policy approach consisting of economic growth, environmental sustainability and healthcare investment.

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