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Child Stunting and Economic Outcomes in SAARC Countries: The Empirical Evidence

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ABSTRACT

Background: Stunting and its economic consequences are gaining increased awareness. As healthy human capital is the key to higher economic growth in the country, according to UNICEF's report in 2018, almost 40% of the total stunted population lives in this South Asian region. Because of the long-term implications, this is of great concern to local and international health organizations and agencies.

Method: This study explores the causal relationship between the socio-economic determinants of child stunting prevalence under 5 years of age in SAARC countries by constructing fixed-effect modelling and the two-stage least square (2SLS) model using instrumental variables; urbanization, governance stability index, and rainfall and temperature anomalies with the GDP per capita variable from 1984 to 2018.

Results: The results reveal that both the variables have a significant causal influence on each other. A 10% rise in gross domestic product per capita reduces child stunting to 6%, implying that economic expansion in this region is presumptively pro-poor. A 1% increase in childhood stunting results in a 3.4% drop in the region's current GDP per capita. The results lie under the critical bound at a 1% level of significance.

Conclusion: The study urges the governments of the SAARC countries to adopt pro-poor policies with an effective mechanism for economic growth transition in the targeted area.

Keywords: Child stunting, Economic growth, GDP, SAARC countries

1- BACKGROUND

Stunting has both short- and long-term consequences. It has a negative impact on a child's mental and physical health, which leads to low academic achievement during the school years. Education achievement, occupational learning challenges, and lower IQ levels all lead to lower incomes, lower productivity, and poor reproductive health in later life. (1). Stunted children's immunity deteriorates and they are always at risk of infection, resulting in decreased performance and becoming a burden rather than a resource for the nation's economy (1). A child who is normally developing and not stunted has a 5.5 percent greater chance of reaching the age of five than a severely stunted child (2). Lifelong consequences of this curse can be averted if a child's linear growth is given adequate attention throughout the first 1000 days of his or her existence. If children receive adequate nutritional care during this time period, the stunting effect in maturity can be reduced. (3-5). The chances of catching up with growth during adolescence are slim, as stunted children frequently have delayed bone maturity (6, 7).

Stunting on a wide scale can result in economic devastation, whether for a household or a country (8). A chronic health condition has a direct resource cost associated with it. This cost includes medication, health care, and other health services associated with the chronic disease (9). Another compelling evidence-based study demonstrates that unsanitary conditions are the primary cause of stunting in South Asia (10, 11). Loss of employment frequently occurs in conjunction with chronic disease, and in some cases, the economic situation of the household deteriorates in the event of early death (1). Occasionally, the expenses are covered by another household or family member who had to forego work or school to care for a sick person at home (1).

Many studies were found on the topic of child stunting, taking different determinants to see how it impacts the child, but the most pervasive and dominant factor contributing to maternal

and child malnutrition in SAARC countries, which include Afghanistan, Bangladesh, Bhutan, India, the Maldives, Pakistan, and Sri Lanka, is widespread poverty and food insecurity. All the other factors stemming from this root cause contributing to maternal and child malnutrition include education, sanitation, and cultural preferences (12).

However, the stunting phenomenon emerges from poverty. The consequences of poverty are multifold, including economic impact. Starting with the household and working up to the country's economy, foremost Stunting affects the productivity of the labor force, which is an important indicator of economic growth. On the flip side, developed countries that have higher economic growth in terms of GDP also have a lower prevalence of stunting. The economist explains the situation as: higher GDP means higher individual household income, resulting in better eating and nutritional food. While stunting is associated with economic growth and economic growth is associated with stunting, establishing a causal relationship between the two is problematic (1). Economic growth is harmed by stunting, and as a counter-balance, economic growth is harmed by stunting. *"..... and as the economy grows, child stunting becomes less prevalent* (1). Subramanian continues...

"Focusing on economic growth that enhances the income of the poorest people and improves the quality and equality of these intermediary inputs is thus likely to be the most effective way of guaranteeing that economic growth leads to lower child stunting rates."

The issue of stunting and economic outcomes is gaining increased awareness among different relevant and concerned people and departments, especially in the context of economic growth in the SAARC region, as almost 40% of the total stunted population prevails in this region (4, 13). Because of the long-term implications, this is of great interest to the government sector and policymakers. Although there is a substantial literature on the prevalence of stunting and its

various consequences (4, 14-18), there is clearly a scarcity of synthesis in literature on SAARC countries that examines the region's communal outlook through the lens of its economic setting. Hence, the literature will add to the evidence through economic context across the eight South Asian states.

The reason for choosing the South Asian region for the review purpose is that (a) they share similar kinds of social, cultural, political, geographical, and economic views and ideologies. (b) Before the subcontinent's independence in 1947, Bangladesh, Pakistan, and India were one country, and thus the nature and behavior of society were more or less common, which will help us understand the reason for stunting better in this region. (c) The study for this region is worthy of research as, globally in 2020, 149 million children under the age of five suffered from stunting, of which 53.8 million (31.8%) are from South Asia (19).

The study will help UNICEF, the government of SAARC countries, stakeholders, and policymakers gain an in-depth understanding of stunting, particularly in this region and how to implement policies to deal with the issue in a better way. The empirical studies on child stunting and economic growth is scant. This study will fill the vacuum by constructing IV models for the relationship between stunting and economic growth, taking into account urbanization, government stability index, and rainfall and temperature anomalies. Moreover, the socio-economic indicator of prevalence of the stunting under 5 years has some missing data for all SAARC countries. Also, the economy, like Afghanistan, had some missing data for GDP per capita. The scarcity of the data has been dealt with interpolation, extrapolation, backcasting and forecasting from the available data using econometrics tools. Understandably, this is a weakness of this study, but stunting is a huge regional health issue and needs to be resolved. Hence, without understanding the approximation of resource loss in numbers and the significance of it through the relationship with

economic growth, it is difficult to measure the comprehensive regional loss. Furthermore, the inclusion of all variables from 1984 to 2018 makes this study representative of almost all stunting evidence.

The rest of the study is structured as follows: Section 2 reviews relevant empirical literature. Section 3 presents data and research methodology; whereas, results are discussed in Section 4. Section 5 concludes the study with policy implications.

2- REVIEW OF LITERATURE

This section reviews selected literature concerning theoretical discussion on the causal relationship between child stunting and economic growth, along with reviewing some empirical studies to explore the dynamics and determinants of both the variables. The review will explore different determinants of stunting, which will help us understand child stunting and its consequences, which will further understand the impact it has on household income and ultimately have an impact on the country's economic growth.

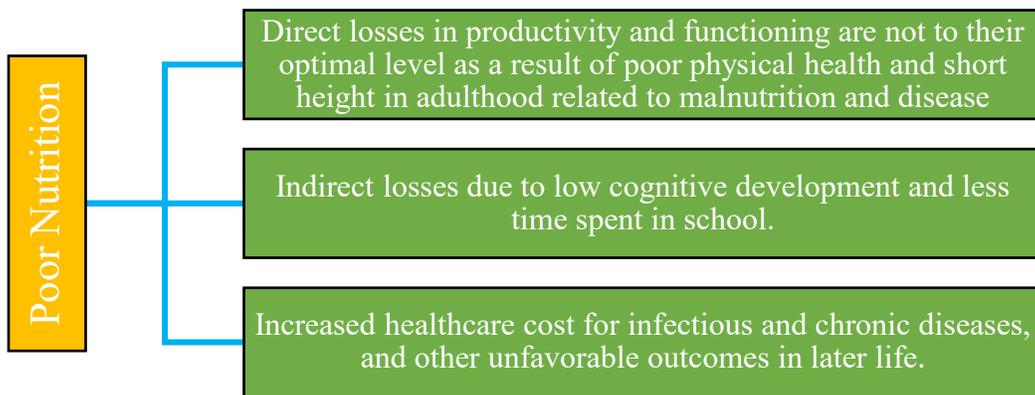
2.1 Short term consequences of stunting on health development

- Stunted mothers are a direct risk factor for complications during pregnancy and delivery, as well as the baby's survival (5, 20)
- Poor nutrition and frequent infections cause a child's nutritional condition to deteriorate and increase vulnerability to infections and diseases (21, 22). Infections provide a clear explanation for the child's nutritional state. It causes a decrease in appetite and energy.
- It plummets the absorption of nutrients (6, 23). The available nutrients in the child's body are diverted from a much-needed growth trajectory towards immunity healing to fight infection (6).

- Concurrent infection associated with stunting increases household expenditure on healthcare (14). This often causes the affected families' already be facing difficulties.
- If the disease and infection are contagious, other children and adults may be at risk, increasing the household cost for caring for the sick child as well as the parent/s and child's attendants' wage loss (14).

In the retrospective studies (14, 24, 25) on stunting and the economic outcome, it is evident that stunting plays a crucial role in economic consequences of an individual, household, and communities. Poor nutrition extends the cycle of poverty and malnutrition, through three main groups:

Figure 1. Three main groups that extends the cycle of poverty and malnutrition



According to the World Health Organization, stunted children earn 20% less than average adult salaries than non-stunted children (26). Malnutrition has a huge economic cost, with annual GDP losses estimated to be in the billions of dollars. According to the World Bank, a 1% decrease

in adult height due to childhood stunting results in a 1.4 percent decrease in economic productivity (27).

(5) conducted a cohort study in Brazil, Guatemala, India, the Philippines, and South Africa, which followed a group of children from birth to adulthood. The study concluded that children born with smaller heights as adult had smaller stature, lower BMI, less time in school, lower cognitive abilities, smaller wages, and stunted women themselves had wasted infants. The growth restriction in the mother's womb many a time results in adverse effects on the fetus, sometimes in form of death or if saved it may face some life-threatening complications (4). Growth restriction in the mother's womb frequently has a negative impact on the fetus, sometimes resulting in death or, if saved, some life-threatening complications (4). (28) in the study of 54 countries on demographic and health surveys found that there is an association between maternal stunting and wasted infants. There is a consistent association between perinatal deaths and maternal stunting (29).

2.2 *Educational and economic consequences of child stunting*

Restricted blood supply, nutrients, and frequent infections are the common causes of small stature, but they also damage the brain, which results in delays in motor skills and cognitive function permanently (30). Using the same group as taken by (5) in their study, (31) found that children stunted till 24 months have a strong relationship with the reduction in schooling, i.e. by 0.9 years, delay in school enrollment, a 16% higher risk of failing in class, keeping gender, socio-economic status, and mother's education constant. Evidence also shows that children stunted between the ages of one and three have poor performance in school and fewer achievements (26). Short stature and lower economic productivity have a link, as shown in a Brazilian study where a 1% increase in height increases wages by 2.4% (32).

In developing countries, linkages were found between demand for labor and labor height (32-38). The strong association between height and wages can also become more authentic when the study of developed countries shows increased earnings for people with attained height (39, 40).

2.3 *Cognitive impairment and Stunting:*

According to one study (30) undernourished children consistently perform worse on attention, fluency, and memorization tests. Severe undernutrition has adverse effects on a child's neurological wellbeing that may result in impaired cognitive development (41). Chronic undernutrition damages the signal transmitting chemical procedure, hence reducing its speed, finally damaging the motor skill abilities and reducing memory consolidation (42).

The cognitive deficit that occurs in early life results in life-long consequences (5). Indian children between 5 and 7 years and from 8 to 10 years were found to be less attentive and had difficulty in memorizing and learning if they were found to be stunted in childhood (30). A study from Zimbabwe by (43) shows that adults who were stunted till the age of 3 years have a deficit in cognitive ability, in comparison with children who is not stunted (44). According to (45) study, one higher grade in school results in a 9% increase in pay.

2.4 *Increased risk of chronic disease and Stunting*

Stunting due to any cause, including malnutrition, undernutrition, undernourishment, a lack of nutrients, infections, sanitation, contaminated food and water, maternal stunting, and/or any other direct or indirect cause, can make a person a higher risk for some type of chronic disease in adulthood.

Dutch famine studies reveal that children born during and immediately after it when they came into their middle age had a higher risk of some chronic diseases as they suffered from impaired glucose metabolism, heart disease, breast cancer, and obesity (46). Similarly, children

born in China in the late 1950s or early 1960s during the Great Chinese famine and Biafrans born during and after the Biafra famine in the late 1960s had an increased risk of chronic diseases like diabetes and hypertension as adult (47, 48). Although, famine is an extreme example, it supports our study on how undernutrition and undernourishment of a mother and an infant can lead to chronic disease when that child grows up to be an adult. A less intense cohort study was done by (49), and the finding showed that the children who were born thinner and with lower BMI, at the age of 32 years had impaired glucose tolerance or were diabetic. (5) study also supports the fact that childhood undernutrition results in a high risk of diabetes, hypertension, and cholesterol concentration in adulthood.

2.5 Economy and Stunting: A Conjoint Phenomena

In the review of literature (50) the severe acute malnutrition (SAM) burden states that six countries in Asia together have more than 12 million children suffering from SAM. (51) in their study, done between 1820 and 1860 on the US and several European states' industrial sector performance, says that "deleterious effect of industrialization on workers was visible in their physical stature".

(52, 53) both study shows that higher the education level, the higher the rate of growth of real GDP. A positive and significant association was found between spending made on education and economic growth (54) A study by (55) found that economic growth, education, and technical progress are connected and positively correlated. Increases in earnings have a positive relationship with additional years of education (56, 57).

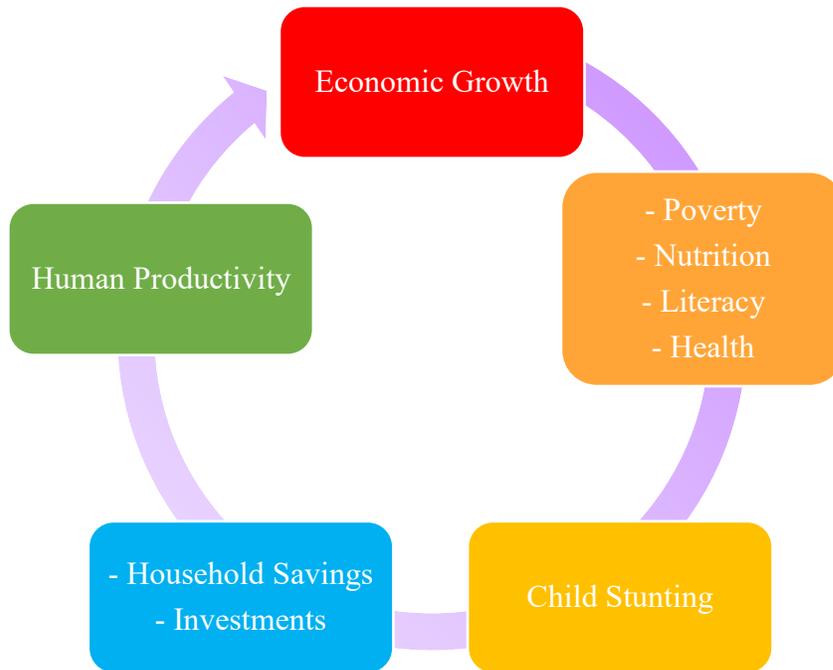
A health deficit at large can result in economic dilapidation, whether of a household or a country. Chronic health condition have a direct resource cost that includes the cost of medicine, medication, health care, and other health services associated with the chronic disease. Loss of

employment comes hand in hand with chronic disease, and sometimes the economic conditions of the household get worse in the event of premature death. Sometimes the expenses are borne by the other household member or family member who has to give up working or attending school so that they can look after the sick person at home. According to DALYs (disability-adjusted life years), chronic disease accounts for 54% of all healthy life years lost (58). Various studies suggest that disease burden, in general, is expected to affect economic growth in particular, and chronic illness reduces the supply of workers caused by morbidity, mortality, and early retirement (8, 9, 59), as well as lowers the person's productivity (60, 61). Direct expenditures are medical expenses incurred by the household for disease prevention, diagnosis, medicine, hospitalization, nutritional food, and other medical treatment of the sick individual (62). To estimate the indirect cost of disease, consider lost labor time due to illness, which impacts the household's ability to earn income when it is most needed to treat the condition (63). The caregiver's indirect costs of illness are 1.42 days per month when devoted to the patient at the time of illness, and for the patient, it is 5.30 days when the effect of illness is on the labor supply (62).

Historical data on adult height estimated an 8% loss in GDP due to adult stunting in the 20th century (64). (65) took data from 36 countries from 1990 to 2011 of children aged 0 -35 months and used a logistic regression model to find a very small to null association between an increase in per capita in GDP and a reduction in childhood nutrition. A study on Ethiopian children done by (66) using a multilevel mixed logistic regression model found that economic growth reduces child undernutrition, yet (67) found a weaker relationship between economic growth and change in malnutrition in his study on Ethiopia. (68) did not find any consistent relationship in India between economic growth and childhood under nutrition. Estimation to see the effect of childhood stunting on adult age for all the developing countries shows that the average per capita

income damage due to stunting is around 7% (69). (70) studied two-periods from 1992-1993 and 2005-2006 in India and found that macroeconomic growth did not result in the poverty reduction that could have translated into a decline in stunting, due to lower spillover effects. China's economic conditions improved between 1990 and 2010 (71). They estimated a negative relationship between GDP and stunting in the country. According to (72), malnutrition-related mortality and illness result in a direct loss of human capital and productivity for the economy in ACP countries. On a micro level, a 1% reduction in adult height as a result of childhood stunting represents a 1.4 percent reduction in a person's productivity. The economic impact of malnutrition is estimated to be between 2% and 3% of ACP countries' GDP. As a result, better-nourished youngsters are more likely to start school and, as a result, enter the labor market earlier (73).

Figure 2. Cycle between Stunting and Economic Growth



The study on Papua New Guinea (74) shows that although there is economic growth, the stunting rate is stagnant due to the eating practices of the mother during the conceived period and feeding practices after childbirth. Furthermore, sometimes, short stature is common and stunting

goes unrecognized by the health worker. PNG is facing the pressure of non-communicable disease due to the low height and increased income used in healthcare that would have been used for nutritious food (74). (75) did the study between psychological factors and stunting in 137 low/middle-income countries, including the SAARC region, and it was found in the study that approximately 7.2 million cases of stunting were attributed to psychological factors; 3.2 million cases of maternal depression showed \$14.5 billion in economic costs, followed by the education of 2.9 million with an economic cost of \$10 billion and Intimate Partner Violence (IPV) 2.1 million with an economic cost of \$8.5 billion. These can have lifetime economic impact.

An association of early child growth restrictions at age 2 and earlier reduces the likelihood of employment in formal sector jobs among young adults 20 years later (15). (16) did the literature study between children's health and the economy, which suggests that children's health is a potentially valuable economic investment and that greater investment results in better educational attainment, leading to productive skilled labor. This sets a favorable demographic change for any country. Further, the study suggests that safeguarding children's health in their childhood is more meaningful than at any other age because failure to do so can lead to lifetime impairment. The study goes on to state that a poor health mechanism has a vicious circle and results in intergenerational poverty transmission. As measured by all scales, children from low socioeconomic status have higher chances of stunting (76).

The results of the study by (77) indicate that wealth inequality is strongly associated with childhood unpropitious growth and stunting and that the poorest 20% of households are three times more vulnerable to suffering from growth retardation than the wealthiest 20%. Results of the study by (18) indicate that the economic burden of early-life growth faltering is substantial and that children in developing countries lose an average of 0.5 years of educational attainment due to

early-life growth faltering. That results in a global economic loss of \$176.7 billion and, on average, \$1400/child loss of lifetime earnings.

The study by (78) shows evidence that although economic growth took place both in Gujarat and Bihar, in Gujarat the undernourished rate of children declined to around 50%, and Bihar showed a very small change in malnourishment. Hence, effective policies are necessary to reduce stunting.

Household wealth of the family matters at an early age for physical growth, and that the condition of poverty and impoverishment can influence growth delays even beyond the 1,000 day window (79). How the labor market gives an advantage to a person's height is explained by (80). They found that a correlation between anthropometric measurement as height and economic conditions prevails in the labor market and it plays a very effective role. Malnutrition results in a higher number of morbidities and mortality, higher expenditure on healthcare, and less education in children, causing less productive economic output and billions of dollars in economic losses (81). A research review by (5) confirms the association between decreased malnutrition and increased economic productivity. In the Copenhagen Consensus (81) it was proved with several pieces of research that malnutrition results in tremendous economic losses, measured in billions of dollars.

3- DATA AND METHODOLOGY

3.1 *Explanation of Data*

Dataset of child stunting prevalence, economic growth, urbanization, government stability index, rainfall, and temperature for a sample of eight SAARC countries namely; Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka from 1984 to 2018 is used

under the pretext that the unavailable data will be interpolated, backcasted and forecasted, through the standard procedure.

Advantages of interpolation

Interpolation is likely to be more accurate than extrapolation as it takes the value within the data. It creates a smooth data effect. If the available data is in some boundary it takes the mean and variance of it and creates similar smooth data (82, 83)

Disadvantages of interpolation

Interpolation is although a simple methodology, but it lacks precision. Every data has different characteristics and can range from random to polycyclic processes. It cannot estimate above maximum or below minimum values (82, 83)

Advantages of backcasting

Backcasting in competitive analysis to improve the understanding of the strategic directions (84-86)

Disadvantages of backcasting

The characteristics that the present data is taking into consideration may lack in past or might have more characteristics in the past which the data is missing out (84, 85).

Advantages of forecasting

The primary advantage of forecasting is that it provides valuable information that the researcher can use to make decisions about the future. Forecasting looks into past and real-time data to predict the future (84, 87)

Disadvantages of forecasting

Forecasts are never 100% accurate. The characteristic that it is taking might not be there in the future (84, 87)

Table 1 gives us descriptive statistics of all our variables used in the research.

Table 1. Descriptive statistics (Number of observations =280)

Variable Names	Obs.	Mean	Std. Dev.	Min	Max
Stunting Prevalence	280	44.87156	15.59905	14.6	79.9592
LNGDP	280	6.547032	0.9593703	5.046053	9.232458
Urbanization	280	24.81673	7.703805	7.121	40.895
Country's Governance index	280	-1.04734	8.436486	-141.313	0.787612
Rainfall Anomaly	280	5.79E-17	0.1240291	-0.58538	0.341772
Temperature Anomaly	280	-2.96E-11	0.0287449	-0.07546	0.085296
Temperature anomaly, squared	280	0.000823	0.0012885	1.18E-10	0.007275
Temperature anomaly, cubed	280	1.00E-06	0.0000981	-0.00043	0.000621
Trade Openness	280	60.45239	37.29013	12.67842	179.1187

Source: Author's construction

3.2 Details of the Variables

Child Stunting: The percentage of children under the age of five whose height for age is fewer than two standard deviations of the median height is known as the prevalence of child stunting. Our data is from the WHO 2018.

Gross Domestic Product (GDP) per capita: For GDP per capita, we used data from the World Bank database. By dividing the total population by the gross domestic product, the gross domestic product per capita are being obtained. Data is in constant 2010 in the US\$(In purchasing power parity). We have used the log of GDP per capita for our estimation purposes.

Government stability index (GSI): Data from World Bank database on Worldwide Governance Indicators which has six components namely; voice and accountability, political stability, and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption has been used. The missing data were interpolated, back-casted, and

forecasted individually component by component. Once the data got up to date, an index was created out of six components and was used in our empirical estimations.

Since food security is primarily dealt by the government and its policy's effectiveness. Therefore, the improved governance reduce stunting by focusing more on providing good, nutritious, and effective distribution of food to its people, hence reducing the chances of stunting (88). Furthermore, the efficient and effective government will ensure other better-living conditions like, improved WASH, education, healthcare, etc. not only for its urban people but also for the rural population as well to slow down the 'urban transition' which puts pressure on cities and towns and standard of living drops there.

Rainfall and Temperature data: Rainfall and temperature data are from the World Bank Database. The dataset is built from monthly observations and converting them into the year. Square and cube of temperature anomaly are also taken in the estimations as it shows the effect of stunting wearing off at a certain point in time and giving a turning point of the relationship, that is, after certain point these natural effects loses its impact. This means that higher temperature (rainfall) increases, the prevalence of stunting but at a consistent level with the increase in temperature (rainfall), stunting increases with decreasing rate. it gives the phase phenomena and gives increase accuracy of the complex temperature (rainfall) system .

Urbanization: Urbanization refers to people living in urban areas as defined by national statistical offices. It is rate as a proportion of the country's population, taken by the World Bank database.

3.3 Model Identification

The empirical model is as follows:

$$S_{it} = \beta \ln(GDP_{it}) + Ygov_{it} + \alpha URB_{it} + c_i + d_t + \mu_{it} \dots \dots \dots Eq. 1$$

Where i = country and t = year; S_{it} = child stunting prevalence of country i in year t ; GDP_{it} is GDP per capita; gov_{it} is a composite index of governance and URB_{it} is the urbanization rate; ci is a country-specific effect, and dt is a time fixed effect. μ_{it} is an error term. β the coefficient of economic growth on child stunting.

Researches like (89-91) have used very few independent variables and have come up with parsimonious equations as using many variables could result in losing the stunting observations which already is scarce and the available dataset is not very extensive and periodic. For a similar reason, we kept on the previous study's track for our research and have kept our model parsimonious and have used the similar variables that have been used by earlier researchers like (92), while focusing on particularly on SAARC region.

Our paper adopts the approach devised by (93) to find the reverse causality between our two main variables namely economic growth and child stunting in a similar way as been done by (92) earlier. Using an instrumental variable (IV) approach, we evaluate the influence of stunting on per capita GDP in the first step of estimation to observe the reverse causality. Equation (2) is:

$$\ln(GDP_{it}) = \omega S_{it} + \pi gov_{it} + \delta URB_{it} + \rho_i + g_t + \tau_{it} \dots \dots \dots Eq.2$$

Country fixed effect = ρ_i ; time fixed effects = g_t ; error term = τ_{it} ; direct endogeneity test of stunting = ω . Rainfall and temperature anomalies (z) are introduced as to estimate GDP per capita requires exogenous variable and written as:

$$z_{it} = (a_{it} - \bar{a}_i) / a_i$$

Mean temperature (rainfall) level over long-run for country $i = a_i$; temperature (rainfall) level in year $t = a_{it}$. Equation (2)'s first stage estimation can be summarized as follows:

$$S_{it} = aT_{it} + bT2_{it} + cT3_{it} + dR_{it} + Xi + Zt + l_{it} \dots \dots \dots Eq3$$

Temperature anomaly = T_{it} ; rainfall anomaly = R_{it} ; Country-specific fixed effects = X_i ; Year dummies = Z_t ; Error term = l_{it} . The second step (**Eg3**) is to create an adjusted per capita GDP series, $\ln(GDP_{it}^*)$, where the sensitivity of per capita GDP to stunting (S_i) is 'partialled out' using estimates from Equation (2):

$$n(GDP_{it}^*) = \ln(GDP_{it}) - \omega S_{it} - \pi gov_{it} - \delta URBit \ln(GDP_{it}^*) \dots \dots \dots Eq4$$

Now the $\ln(GDP^*)$ is free of the endogeneity and is used to instrument $\ln(GDP_{it})$ in estimating **Eq1** via 2SLS. This identifies the causal relationship between economic growth and child stunting. This indirectly proves, that the presence of endogeneity while other variables are assumed exogenous.

This method establishes the causal association between economic growth and stunting, as well as the reverse causality between stunting and economic growth.

The rationale for the identification strategy of rainfall and temperature is that, first; these variables are exogenous and random. Secondly, the earlier literature review suggests that the child's physiology gets affected by the weather shocks and have a strong likelihood to correlate with stunting prevalence (94, 95). Third, stunting is a chronic illness that isn't fully determined until the first two years of life, so it isn't a one-time occurrence (89, 96).

According to the theory, current weather anomalies are natural physiological shocks that influence future stunting and, as a result, GDP per capita. An exogenous source of variation in per capita GDP growth is necessary to calculate the impact of GDP per capita on stunting. To generate such variation, we use smooth variation in rainfall and temperature anomalies as IVs. A key characteristic of the SAARC region that makes this estimation plausible is that these countries are highly dependent on agriculture (97). Another reason is that higher temperature tends to increase

in vector-borne diseases (98). The rainfall shocks have multiple effects too; crop cycle, drought, flooding, disease are the common elements that are associated with excessive and scarce rainfall.

Hansen & Sargan is a test of over-identification. The null hypothesis that the instruments are uncorrelated with the error term is tested in this way. If the p-value is less than 10%, we can conclude that all instruments are not exogenous and thus invalid. We compare the crucial values through Stock and Yogo (99) to test the weak instruments to the Wald F statistic to verify the instrument's strength. This hypothesis is tested by determining whether the maximum relative bias and size distortions are larger than 10%, 15%, or 20%.

A stunting prevalence observation in a given year, according to (92), is the result of one or more years of economic performance prior to that year, and hence, recommend using a model in which regressors are replaced by their five-year moving averages. Eq1 can so be represented as:

$$S_{it} = \xi \ln(GDP_{it}^{ma5}) + \lambda gov_{it}^{ma5} + \pi URB_{it}^{ma5} + \nu i + \theta_t + \zeta_{it} \dots \dots Eq.5$$

Where the superscript **ma5** denotes the five-year rolling average of the regressors; the log of GDP, urbanization, and government stability Index. Each regressor has been calculated taking the current time and time of four previous years. 5 years moving average of GDP is calculated as:

$$\ln(GDP_{it}^{ma5}) = 1/5 [\ln(GDP_{it-1}) + \ln(GDP_{it-2}) + \ln(GDP_{it-3}) + \ln(GDP_{it-4}) + \ln(GDP_{it})]$$

ξ represents the average impact of economic growth over the previous four years and the current year on the prevalence of stunting.

4- RESULTS

The association between economic growth and the prevalence of child stunting is estimated in the study using Stata 13. We conducted stepwise estimations (Table 2.) to reveal the best estimation approach for the research².

² Detail of stepwise estimation are available in the supplementary material

Our data comes from eight countries, totaling 280 observations; each country has 35 years of observations. We used a panel data approach for our estimation.

Table 3 shows the effect of stunting on economic growth using the ordinary least square method (OLS) taking the dependent, independent, and instrumental variables that we will be using for our two-stage least square estimation (2SLS).

Table 2. Estimations to find the best approach to find effect of stunting on economic growth

	Pooled OLS	OLS-FE	OLS-RE
Dependent Variable	Stunting	Stunting	Stunting
GDP per capita	-14.6329*** (-21.45) [0.000]	-6.6791*** (-9.04) [0.000]	-7.1038*** (-9.65) [0.000]
Urbanization	0.2506*** (2.95)	-1.1073*** (-10.41)	-1.0359*** (-9.81)
Governance stability index	-0.0378# (-0.61)	-0.0088# (-0.24)	-0.0105# (0.28)
R²	69.32***	79.51***	77.48***
DW	n.a.	n.a.	n.a.
Redundant Fixed Effects Tests, p-value	n.a.	0.000	n.a.
Rho	n.a.	84.62%	71.24%
Hausman Test	n.a.	n.a.	Chi ² = 31.69 p= 0.000
B-P Test for RE	n.a.	n.a.	Chi ² =1011.57 p=0.000
Wald test	n.a.	n.a.	Chi ² = 242.08 p=0.000
B-P Test for independence	n.a.	n.a.	Chi ² = 297.25 P=0.000
Pesaran Test	n.a.	n.a.	2.015 p=0.0439

Source: Author's construction and dependent variable is child stunting (Y_{it})

Notes *, **, ***: significant at 10%, 5% and 1%. #: insignificant (p -value >15%), ##: marginally insignificant (p -value <15). Country-clustered t -value in parentheses. Anderson-Rubin p -value in Square bracket

Table 3. The effect of stunting on economic growth (OLS)

	OLS	OLS	OLS-FE	OLS-FE	OLS	OLS	OLS-FE	OLS-FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	GDP per capita	GDP per capita	GDP per capita	GDP per capita	Stunting prevalence	Stunting prevalence	Stunting prevalence	Stunting prevalence
Stunting prevalence	-0.0427*** (-21.46) [0.000]	-.04433*** (-20.49) [0.000]	-0.0349*** (-9.04) [0.000]	-0.0348*** (-8.51) [0.000]				
GDP per capita					-14.6330*** (-21.46) [0.000]	-13.6852*** (-20.49) [0.000]	-6.6791*** (-9.04) [0.000]	-6.1655*** (-8.51) [0.000]
Urbanization	0.0389*** (9.67)	0.0411*** (9.95)	0.0492*** (5.73)	0.0529*** (6.12)	0.2506*** (2.96)	0.35865*** (4.38)	-1.1073*** (-10.41)	-0.9082*** (-8.31)
Governance stability index	0.0006# (0.17)	.0003 # (0.08)	-0.0013# (-0.51)	-0.0015 # (-0.58)	-0.0379 # (-0.61)	-0.0407# (-0.70)	-0.0088 # (-0.24)	-0.0031 # (-0.09)
Rainfall anomaly		0.2123# (0.91)		0.2565 # (1.43)		-0.2392# (-0.06)		-1.3038 # (-0.54)
Temperature anomaly		-0.5913 # (-0.31)		1.0787 # (0.66)		-100.65*** (-3.08)		-97.931*** (-4.68)
Temperature anomaly, squared		30.646 3 (1.31)		34.262 ## (1.61)		1440.58*** (3.58)		47.661 # (0.17)
Temperature anomaly, cubed		-526.08 # (-1.01)		-736.04* (-1.77)		-160.81 # (-0.02)		10360.62* (1.88)
Observation	280	280	280	280	280	280	280	280
Number of Countries	8	8	8	8	8	8	8	8
Country fixed effect	n.a.	n.a.	Yes	Yes	n.a.	n.a.	Yes	Yes
Year Fixed effect	n.a.	n.a.	Yes	Yes	n.a.	n.a.	Yes	Yes
R ²	76.32***	76.94***	71.87***	77.94***	69.33***	73.07***	77.51***	79.92***
F-stats overall	n.a.	n.a.	27.60***	27.76***	n.a.	n.a.	79.71***	76.57***

Source: Author's construction and dependent variable is child stunting (*Sit*) and for the reverse causal the dependent variable is GDP (*lnGDP*)

Notes *, **, ***: significant at 10%, 5% and 1%. #: insignificant (p -value >15%), ##: marginally insignificant (p -value <15). Country-clustered t -value in parentheses. Anderson-Rubin p -value in Square bracket

4.1 Two-Stage Least Square estimation

Two-stage least squares (2SLS) regression analysis is a statistical approach used in structural equation analysis. The OLS approach has been extended with this methodology. It is employed when the error terms of the dependent variable are associated with the independent variables.

We used the Instrumental Variable (IV) technique in this study because if we do not account for other innate contributors to stunting or economic growth, we risk exaggerating the contribution of stunting to economic growth or economic growth to stunting. Thus, if we perform regression between the two variables, it is likely to be connected with the regression's error term, which might include variables such as urbanization, government performance, temperature, or rainfall. In our scenario, both stunting and economic growth are endogenous regressors that can produce spurious results when we use OLS regression. As a result, the classical regression model (CLRM) assumptions are likely to fail to satisfy the assumption that the "expected value of the error term, given the value of the regressor, is zero" because there is a high likelihood of a correlation between the two variables and that the regressors are truly exogenous. So, whether stunting increases as a result of economic growth or decreases as a result of economic growth, stunting can be influenced indirectly, if not directly, by other variables. We employed the IV technique to avoid this contradiction in the calculation of the regressor coefficient.

To determine whether there is reverse causality between our two variables, we employed the 2SLS approach. The post-estimation test for weak, valid, and endogenous instruments is inferable in the 2SLS approach, which allows us to accurately comprehend the result and draw a better inference. The precision of the conclusion is only regarded through the interpolated data that we calculated, which was also a restriction due to the shortage and variability in accessible stunting

data. Using country-clustered standard errors, the result is used to test robustness for heteroscedasticity.

Table 4 presents estimates for the impact of child stunting on current GDP per capita, demonstrating that GDP per capita is clearly endogenous for child stunting. In Table 4, column 1, the first-stage estimations employ the 2SLS approach to examine the relationship between rainfall and temperature anomalies and child stunting. Rainfall levels that are higher than usual have been associated with a decrease in the prevalence of stunting. According to a coefficient for the beguilement in the temperature shock, the relationship between temperature and stunting is not linear, and small-scale negative temperature shocks increase stunting prevalence and vice versa.

An increase in child stunting prevalence reduces GDP per capita by 3.4 percent, according to the estimate in column 2 of Table 4.

OLS estimations of the impact of GDP growth on stunting are expected to be negative due to the negative reverse causal effect. The F-statistics indicate that weak instruments are not a concern in the estimation in Column 2 because they are significantly more than the Stock–Yogo threshold value of 20%. Durbin and Hausman's low probability values are less than 10%, implying that GDP per capita is exogenous. The p-values for the Hansen and Sargan tests in column 2 are greater than 10%, indicating that the tests do not rule out the possibility that the instruments are uncorrelated with the second-stage error. We re-estimated Equation 2 in columns 3, 4, and 5 by including rainfall and temperature anomalies. The coefficients demonstrate that the link between stunting and economic growth is nonlinear, i.e., stunting reduces as economic growth increases.

Table 4. The two-stage least square (2SLS) estimations of stunting on economic growth

	First stage	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)
Dependent Variable	Stunting prevalence	GDP per capita	GDP per capita	GDP per capita	GDP per capita
Stunting prevalence		-0.0344*** (-6.78) [0.000]	-0.0348*** (6.78) [0.000]	-0.0395*** (-5.12) [0.000]	-0.3752*** (-4.71) [0.000]
Urbanization	0.5190*** (-4.67)	0.0459*** (8.02)	0.0458*** (8.04)	0.0434*** (6.91)	0.0445*** (6.95)
Governance stability index	-0.1132 # (-1.23)	0.0016 # (0.46)	0.0015 # (0.44)	0.0011 # (0.31)	0.0012 # (0.36)
Rainfall anomaly	-7.9957 # (-1.22)		0.3147 # (1.35)		0.2802 # (1.16)
Temperature anomaly	-235.4237*** (-4.62)			-1.3986 # (-0.86)	-0.7764 # (-0.45)
Temperature anomaly, squared	2597.092*** (4.10)				
Temperature anomaly, cubed	17900 # (1.23)				
Observation	280	280	280	280	280
Number of Countries	8	8	8	8	8
Country fixed effect	No	No	No	No	No
Year Fixed effect	No	No	No	No	No
R²	31.52***	74.84***	75.75***	76.25***	75.95***
Durbin (score), prob-value		0.0643	0.0718	0.5404	0.3966
Wu-Hausman, prob-value		0.0661	0.0743	0.5404	0.4027
First-stage, F-stats		13.31***	17.72***	7.28***	10.42***
Stock & Yogo 10% size		24.58	22.30	22.30	19.93
Stock & Yogo 20% size		10.26	9.54	9.54	8.75
Stock & Yogo 20% relative bias		10.27	9.08	9.08	n.a.
Stock&Yogo 20% relative bias		6.71	6.46	6.46	n.a.
Hansen & Sargan, p-value		0.3082	0.4090	0.2157	0.1922

Source: Author's construction and dependent variable is GDP (*ln GDP*)

Notes *, **, ***: significant at 10%, 5% and 1%. #: insignificant (p -value >15%), ##: marginally insignificant (p -value <15). Country-clustered t -value in parentheses. Anderson-Rubin p -value in Square bracket

4.2 GDP on child stunting effects

Table 5 shows estimates of the influence of GDP growth on child stunting. The 2SLS coefficients are greater than their OLS equivalents, indicating that negative reverse causality exists. All of the 2SLS coefficients are negative, significant at 1% in column 2, and imply that a 10% rise in GDP per capita would result in a 6%³ reduction in stunting prevalence.

³ This is calculated as $(26.9542/44.871) * 10/100 \approx 6.006$

Lastly, we found that urbanization has a positive and mostly significant impact of 1% on stunting, which implies that with more urban transition due to the factors mentioned in the literature review, it is evident that urbanization plays quite a part in stunting prevalence. Governance, although it mostly has a negative coefficient that implies that good governance leads to a decrease in stunting, is insignificant with the high p-value. Rainfall shocks do not affect stunting in any of our estimations, while temperature shocks have a negative impact on stunting.

Table 5. Two-stage least square (2SLS) estimation of economic growth on child stunting

	First stage	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)
Dependent Variable	GDP per capita	Stunting prevalence	Stunting prevalence	Stunting prevalence	Stunting prevalence
GDP per capita		-26.9542*** (-7.15) [0.000]	-27.7505*** (1.2416) [0.000]	-22.6981*** (-5.45) [0.000]	-24.8470*** (-4.93) [0.000]
Urbanization	0.0641*** (10.13)	1.1765*** (3.92)	1.2416*** (3.95)	.9198*** (3.08)	1.0621*** (2.98)
Governance stability index	0.0053# (1.00)	.0342# (0.37)	.0379# (0.39)	.0127 # (0.16)	.0233# (0.27)
Rainfall anomaly	0.5667# (1.53)		8.7901# (1.36)		6.5360# (1.03)
Temperature anomaly	.9847*** (3.39)			-48.511## (-1.54)	-30.7679# (-0.79)
Temperature anomaly, squared	-84.508** (-2.34)				
Temperature anomaly, cubed	-1319.80## (-1.59)				
Observation	280	280	280	280	280
Number of Countries	8	8	8	8	8
Country fixed effect	No	No	No	No	No
Year Fixed effect	No	No	No	No	No
R²	41.34***	33.05***	2870***	54.49***	45.08***
Durbin (score), p-value	n.a.	0.000	0.000	0.0066	0.0021
Wu-Husman, p-value	n.a.	0.000	0.000	0.0069	0.0023
First-stage, F-stats	n.a.	5.25017	6.8449	3.91378	4.85758
Stock-Yogo 10% size	n.a.	24.58	22.30	22.30	19.93
Stock-Yogo 20% size	n.a.	13.96	9.54	9.54	8.75
Stock-Yogo 20% relative bias	n.a.	10.27	9.08	9.08	n.a.
Stock-Yogo 20% relative bias	n.a.	6.71	6.46	6.46	n.a.
Hansen-Sargan, p-value	n.a.	0.0643	0.3894	0.1757	0.1791
F-stats overall	93.52***				

Source: Author's construction and dependent variable is child stunting (S_{it})

Notes *, **, ***: significant at 10%, 5% and 1%. #: insignificant (p -value >15%), ##: marginally insignificant (p -value <15). Country-clustered t -value in parentheses. Anderson-Rubin p -value in Square bracket

4.3 *Alternative model using 5-Year moving averages*

We have reproduced Equation 5, in which the regressors are given as 5-year moving averages. This estimation has the advantage of assisting us in determining the impact of, for example, this year's stunting as a result of the previous four and current year's GDP. The problem with this estimation is that we may not be able to compare this with Table 3 because Equation 5 implies a different structural model. Nonetheless, if the result shows similar evidence in estimations, it would give reassurance to our estimations of previous analysis but still we cannot ignore the fact that stunting data is been interpolated due to scarcity and inconsistency in available data.

Our estimations in Table 6 on 5-years moving average also indicates that stunting affects economic growth and is highly significant. In the same line Table 7 shows that economic growth also plays an important role in stunting and is highly significant in 5-years.

Table 6. The estimation of stunting on economic growth by 5 years moving average method

	OLS	OLS-FE	First stage	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable	GDP per capita	GDP per capita	Stunting	GDP per capita	GDP per capita	GDP per capita	GDP per capita
Stunting prevalence	-0.0400*** (-20.26) [0.000]	-0.0309*** (-8.26) [0.000]		-0.0307*** (-6.21) [0.000]	-0.0307*** (-6.24) [0.000]	-0.0360*** (-4.84) [0.000]	-0.0339*** (-4.34) [0.000]
Urbanization	0.37607*** (9.28)	0.0521*** (9.28)	-0.5315*** (-4.74)	0.0458*** (7.93)	-0.0459*** (7.94)	0.0431*** (6.85)	0.0444*** (1.23)
Governance stability index	0.0072 # (0.99)	-0.0036 # (-0.58)	0.6369*** (-3.14)	0.0122 ## (1.53)	0.0126 # (1.59)	0.0089 # (1.06)	0.0107 # (1.23)
Rainfall anomaly			-9.4633 ## (-1.48)		0.3025 # (1.31)		0.2613 # (1.09)
Temperature anomaly			-247.03*** (-4.94)			-1.5012 # (-0.94)	-0.8646 # (-0.50)
Temperature anomaly, squared			2578.38*** (4.12)				
Temperature anomaly, cubed			20372.96 ## (1.42)				
Observation		248	248	248	248	248	248
Number of Countries		8	8	8	8	8	8
Country fixed effect		Yes	n.a	n.a	n.a	n.a	n.a
Year Fixed effect		Yes	n.a	n.a	n.a	n.a	n.a
R²	75.04***	69.86***	33.96***	73.01***	73.22***	74.86***	74.38***
Durbin (score), prob-value				0.0295	0.0305	0.4340	0.2997
Wu-Husman, prob-value				0.0304	0.0318	0.4391	0.3058
First –stage, F-stats				14.23	18.97	7.81	10.95
Stock & Yogo 10% size				24.58	22.30	22.30	19.93
Stock & Yogo 20% size				10.96	9.54	9.54	8.75
Stock & Yogo 20% relative bias				10.27	13.91	13.91	n.a
Stock & Yogo 20% relative bias				6.71	6.46	6.46	n.a
Hansen & Sargan, p-value				0.3111	0.3951	0.2294	0.1944
F-stats overall		27.46***					

Source: Author's construction and dependent variable is GDP (*lnGDP*)

Notes *, **, ***: significant at 10%, 5% and 1%. #: insignificant (p -value >15%), ##: marginally insignificant (p -value <15). Country-clustered t -value in parentheses. Anderson-Rubin p -value in Square bracket

Table 7. The estimations of economic growth on stunting by 5 years moving average method

	OLS	OLS-FE	First stage	2SLS-IV	2SLS-IV
	(1)	(2)	(3)	(4)	(5)
Dependent Variable	Stunting	Stunting	GDP per	Stunting	Stunting
Stunting prevalence	- 14.9364 *** (-20.26) [0.000]	-6.5529*** (-8.26) [0.000]		-29.8539*** (-6.61) [0.000]	-27.156*** (-4.60) [0.000]
Urbanization	.2076 ** (2.34)	-1.2034*** (-10.70)	.0626*** (10.15)	1.294*** (3.73)	1.152 *** (2.83)
Governance stability index	-.1031 # (-0.73)	.0145 # (0.16)	.0323 *** (2.91)	.3191 # (1.25)	.2432 # (0.91)
Rainfall anomaly			.5673 ## (1.61)		6.460 # (0.93)
Temperature anomaly			9.2526*** (3.36)		-37.392 # (-0.91)
Temperature anomaly, squared			-73.452** (-2.14)		
Temperature anomaly, cubed			-1328.26* (-1.69)		
Observation	248	248	248	248	248
Number of Countries	8	8	8	8	8
Country fixed effect		Yes	No	No	No
Year Fixed effect		Yes	No	No	No
R²	67.91 ***	76.02**	42.01***	20.30***	36.80***
Durbin (score), p-value				0.000	0.0010
Wu-Husman, p-value				0.000	0.0010
First –stage, F-stats				4.83706	4.51556
Stock-Yogo 10% size				24.58	19.93
Stock-Yogo 20% size				10.26	8.75
Stock-Yogo 20% relative bias				10.27	
Stock-Yogo 20% relative bias				6.71	
Hansen-Sargan, p-value				0.2552	0.1697
F-stats overall		77.47***			

Source: Author's construction and dependent variable is child stunting (S_{it})

Notes *, **, ***: significant at 10%, 5% and 1%. #: insignificant (p -value >15%), ##: marginally insignificant (p -value <15%). Country-clustered t -value in parentheses. Anderson-Rubin p -value in Square bracket

5- DISCUSSION

Human capital is priceless and is measured by health and education in a country. Human capital that is healthier and more efficient contributes to greater economic growth. Similarly, less skilled and unhealthier human capital is more likely to become a burden. This inefficient productivity problem has an impact on a country's GDP. Stunting in childhood has an impact on a person's health and productivity in adulthood. Expenses for weakened immunity, chronic sickness, health transmission to the next generation, and other factors may exacerbate a person's financial condition.

Despite the fact that the SAARC region's human capital is among the top ten out of 195 countries, there are significant differences in human productivity levels. Stunting costs low-income developing countries, especially those in South Asia, up to 3% of their GDP. Stunting results in the biggest human capital losses in this region and can have irreversible, long-term consequences that impede economic growth, resulting in a significant impact on the country's GDP. According to the estimates, stunting lowers per capita income. Stunting in childhood has been linked to lower school attendance. This could be due to inadequate motor and cognitive skills, frequent infections and illnesses, chronic disease, and other stunting-related challenges. Adults with little education and health issues have a more difficult time obtaining work in a competitive economy. If they do find jobs, their performance is lower than that of a person who was not stunted in childhood due to their inferior physical and mental capacity.

Faster economic growth, as indicated by developed countries, lessens stunting. Economists relate this to rising per capita GDP. Macroeconomic shocks have an impact on income, which in turn has an impact on generations. Institutions attempting to minimize stunting prevalence must

improve policies and interventions such that GDP or national income growth has no or little influence. Furthermore, policies must reach a bigger number of effected individuals.

The research presented the effects of rising current GDP per capita on child stunting in the SAARC area, which comprises Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. The 2SLS is a method for determining the reverse causal link between dependent and independent variables, and we were able to do so successfully. Our data suggests that a 10% rise in GDP per capita reduces the frequency of child stunting by 6%. (6.7 percent by the five-year moving average method).

The comprehensive analysis also reveals that our estimate is in the same ballpark as our previous estimates. We also calculate the GDP per capita effects of stunting in the reverse causal direction. And the results show that every percentage point increase in child stunting causes a 3.5 percent drop in current GDP per capita.

6- CONCLUSION

Stunting has reasons and consequences attached to it. It affects the child's mental and physical health, which has an impact on its productivity in every aspect of life. This productivity lag affects its income earning in adulthood. If seen from another angle, the expenditure made on the stunted child has an impact on the other siblings' food, health, and education along with the earner's income, which drifts the household into a deeper poverty level. The literature suggests that there is an inverse relation between poverty and GDP per capita. Hence, the more non-productive and poor the nation, the lower the GDP of that country.

The WHO's sustainable development goal (SDG) includes a major focus on how to reduce child stunting. Stunting and all forms of undernutrition are the objectives that they want to curb by 2030 by all means. Research has proven that economic growth can be a key to achieving the goal.

While studies prove that economic growth can play a role in the development of every country, This pretext gave the researchers reason to consider how far it can be beneficial for lowering stunting prevalence, as economic growth is essential in every way. The empirical results gave mixed results as far as the magnitude of the impact is concerned. The magnitude of the result can vary as the data is interpolated due to the scarcity and inconsistency of data, and this is the limitation that we faced.

We found that economic growth is moderately pro-poor. Also, the study suggests that economic growth is not the only means that is enough for the reduction in stunting prevalence; other supportive attributes are also needed. If any SAARC country is serious about this curse, they need to focus on directional, focused, effective, and efficient interventions. The estimation was unable to find any significant relation between governance and the decrease in stunting.

Our research can be of great help to policymakers in giving directions to the strategies that they use to influence stunting in the downward direction. Policymakers should make sure that the strategies they suggest are pro-poor.

Although this approach can be beneficial in other development sectors, if the right instrument is identified, the result will be unbiased. We can extend this research further by using other instruments, such as trade openness, education, etc., to see how they affect our results. We recommend that more research in line with this can give a clearer picture of how the reduction in stunting is workable in better ways. This approach also has its limitations, as it cannot be applied to smaller areas or places where the data is completely unavailable. An extensive amount of data is required to conduct this kind of research for an unbiased result. In the absence of data, interpolation is also not possible, as the procedure requires some minimum amount of data for the

empirical investigations. Finally, more research could be done to determine the type of economic growth that is a stronger predictor of stunting reduction.

LIST OF ABBREVIATION

DALY	Disability Adjusted Life Years
GDP	Gross Domestic Product
IPV	Intimate Partner Violence
IV	Instrumental Variable
OLS	Ordinary Least Square
SAARC	South Asian Association for Regional Cooperation
SAM	Severe acute Malnutrition
SDG	Sustainable Development Goals
Stata	Software for Statistics and Data Science
UNICEF	The United Nations Children's Fund
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
2SLS	Two-stage least square

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Formal analysis: MSN. AB.

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