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Estimating the roles of dependency ratio and economic growth on child mortality in SAARC countries: Evidence from panel data analysis

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Abstract: In developing nations like the SAARC, child mortality is an issue. The health status of an economy can be effectively assessed through its significant indicators. In situations where mortality rates are elevated, there is a corresponding increase in the fertility rate as parents seek to compensate for the higher likelihood of child mortality. This leads to a decrease in the allocation of resources per child in terms of education and healthcare, inadvertently hindering the development of human capital and perpetuating the cycle of poverty and illness. National GDP is lowered by high death rates. This study estimates the roles of dependency ratio and economic growth on child mortality using cross-country data for SAARC countries. The study applies panel data techniques (Fixed Effect Model, Random Effect Model, Generalized Least Square Regression, and Panel Corrected Standard Error regression). Based on the Hausman Specification Test, the preferred model is Random effect model. In the case of heteroscedasticity, the better choice is GLS regression, especially when T is greater than cross-sections N. However, the study also estimates panel-corrected standard error regression. The findings reveal that there is a positive relationship between child mortality and the dependency ratio and a negative one between child mortality and economic growth. The study additionally evaluates the cumulative impacts of both variables on it. The findings indicate that the impact of both variables remains consistent. The policy implications are that economic growth-maximizing and dependency ratio-minimizing policies should be adopted. The study contributes to the existing literature by finding the role of dependency ratio in child mortality, at least with respect to SAARC countries.

Keywords: *Child mortality, Dependency ratio, Economic growth, Panel data models.*

1. Introduction

Thus, child mortality, or CM, is an issue in developing nations like the SAARC countries. Increased newborn and CM rates indicate sensitive public health circumstances, which act as roadblocks to the development of effective human capital (henceforth HC) [1]. They lower future spending on goods and services, the labor force, short-term household savings and investments, the number of future taxpayers and subsequently the amount of tax revenue they receive, and the number of future export producers and the amount of export earnings they receive [2].

Illness and malnutrition's effects may be broken into two components: child and adult, which determine the labor productivity level. The component of adults has a direct effect on the productivity of labor and indirect effects through less contact with natural resources of the economy. Lesser labor yield also results from less investments in bodily capital, attributable to impaired access to resources and an inability to make a direct physical contribution. The illness of a child disturbs labor productivity indirectly

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via fewer schooling and lessened intellectual aptitudes produced by malnourishment. Moreover, the health of an individual as a child partially regulates their health status as a grownup as well [3, 4]. The disease and illness impact mortality and life expectancy (henceforth LE) [5, 6]. Short LE depresses individuals from investing in health and education because of comparatively short payment periods and high uncertainty [7-9].

On the other side, infant and CM reduction will lead to fertility reduction and a rise in schooling [7]. The process of economic growth (henceforth EG) results in a mortality decline and an increase in investment in HC [7]. The anticipation of extended superannuation periods resultant from a reduction in mortality often results in larger savings during an active life that contribute to raising the physical capital stock per worker [10]. Lower rates of mortality and the abolition of mortal ailments raise LE and healthcare costs [11].

The under-five CM is a key indicator of the well-being of a child, consisting of health and nutritional status. It is also an important gage of the child survival interventions' coverage as well as of social and economic development [12]. CM was included in the United Nations Millennium Development Goals (MDGs). The target was to reduce CM to sixty percent by 2015 in developing nations [13]. The reduction of child mortality was an essential goal because it addressed the high rates of deaths among children under five years old in developing countries. Many children in these countries die from preventable diseases such as pneumonia, diarrhea, and malaria, which can be treated or prevented with simple and cost-effective interventions. The MDGs' focus on reducing child mortality led to increased investments in maternal and child health, immunization programs, and a better approach to hygienic water and cleanliness. As a result, the under-five CM decreased to 43 death per 1,000 live births (henceforth LB) in 2015 from 91 death per 1,000 LB in 1990, exceeding the target set by the MDGs.

CM was also included in the Sustainable Development Goals (SDGs). The SDGs consist of 17 goals established by the United Nations General Assembly to realize a better and more sustainable future for all. These goals cover several areas, including health, education, poverty, gender equality, and climate action, among others. One of the SDGs is to guarantee healthy and hearty lives and encourage welfare for all at all ages, particularly goal 3. This aim consists of a target to decrease the under-five CM to at least as low as 25 per 1,000 LB. This is an ambitious target, but progress has been made in recent years. The World Health Organization (WHO) shows that the global under-five mortality rate declined to 38 deaths per 1,000 LB in 2019 from 93 deaths per 1,000 LB in 1990.

This progress has been made possible due to various factors, such as improved healthcare services, a healthier diet, augmented access to vaccines, and improved hygiene amenities. However, CM remains a significant challenge, especially in low-income countries, particularly in sub-Saharan Africa and South Asia, where the under-five mortality rate is still very high. In 2019, sub-Saharan Africa accounted for nearly half of all child deaths worldwide, with a CM rate of 76 deaths per 1,000 LB. South Asia had the second-highest CM rate, at 44 deaths per 1,000 LB. In contrast, the lowest under-five mortality rates are found in high-income countries, where the rate is 5 deaths per 1,000 LB.

There are so many studies that show that income inequality and illiteracy are important factors that affect CM in underdeveloped countries [14]. The following studies explored determinants of CM and found income as an important variable to affect CM around the globe [7, 15, 16]. Whereas Amonker and Brinker [17] found living standards to be an important factor in affecting CM in India. Arntzen and Andersen [18] explored the determinants of CM in Nordic countries. Wang [19] showed factors *affecting* CM and revealed income as an important factor affecting CM in low-income countries. Schell, et al. [20] discovered factors affecting CM in low, medium, and high countries and found GNI per capita as an important variable to affect it. Kim and Saada [21] found income inequality to be an important variable to affect CM in Western developed countries. Haroun, et al. [22] explored the determinants of CM in Sudan and found mother education to be an important variable to affect CM. Kirigia, et al. [2] found the determinants of CM and showed education as an important variable to affect it in African Regions. Khan and Awan [23] found parental education and the mother's working status to be important factors affecting CM in Bangladesh. Bugelli, et al. [24] explored the factors affecting infant mortality in Brazil

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and found employment to be an important factor in affecting it. But there is little evidence to identify the factors affecting CM in the SAARC countries. Further, there is scanty literature to find the role of dependency ratio towards CM, especially in these countries. Thus, the study aims at estimating the role of dependency ratio (henceforth DR) and EG on CM in these countries.

The study's structure is outlined as follows: following the introduction, the second portion provides a description of the data and methods, while the third section presents an analysis of the findings. The final portion serves as the concluding segment of the paper.

2. Data and Methodology

2.1. Data

The study uses data on child mortality, economic growth, and dependency ratios taken from the Global Data Lab (GDL). SAARC, which stands for South Asian Association for Regional Cooperation, is the regional intergovernmental organization and geopolitical blending of states in South Asia. Its joining countries are Pakistan, Afghanistan, India, Bangladesh, Nepal, Maldives, Sri Lanka, and Bhutan. It consists of 21% of the world's population, 3% of the world's land area, and 5.21% (USD 4.47 trillion) of the worldwide economy as of 2021. It was created on eighth December 1985, in Dhaka, Bangladesh. It has its secretariat in Kathmandu, Nepal. The body encourages regional integration and economic development. It started the South Asian Free Trade Area in 2006. It keeps perpetual ambassadorial relationships at the United Nations as an observer and has established relations with multilateral entities, including the European Union. Out of these SAARC countries, this study takes Pakistan, India, Bangladesh, Nepal, and the Maldives based on the availability of data for the same years.

2.2. Methodology

To find out the roles of dependency ratio and EG on child mortality, the following econometric model is used:

$$lChm_{it} = \beta_0 + \beta_1 DR_{it} + \beta_2 EG_{it} + \mu_{it}$$

Where:

lChm = log of Child mortality

$$DR = dependency\ ratio = \frac{Number\ of\ children\ with\ age <= 14\ years\ \&\ old\ individuals\ with\ age > 64\ years}{Individuals\ with\ age > 14\ years\ \&\ individuals\ with\ age < 65\ years}$$

EG_{it} = Economic Growth. Gross National income per capita (henceforth GNI) is used as a proxy for economic growth.

μ = Error term.

i represent a panel that is country in this study.

t represents the time.

Hypothesis-1:

Ho: $\beta_2 = 0$ (relationship between child mortality and dependency ratio does not exist)

H1: $\beta_2 > 0$ (positive relationship between child mortality and dependency ratio exist).

Hypothesis-2:

Ho: $\beta_1 = 0$ (Association between CM and EG does not exist).

H1: $\beta_1 < 0$ (negative association between CM and EG exists).

3. Results and Discussions

One of the major problems facing developing economies like SAARC countries is Child mortality. The study aims at finding the factors affecting it in SAARC countries. The descriptive statistics are given in Table 1.

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Table 1.
Descriptive statistics.

Variables	Mean	Standard deviation	Minimum	Maximum
Child mortality	57.08	23.143	19.6	97
Gross national income per capita#	6.371	4.86	2.15	17.8
Dependency ratio	64.35	9.06	53.3	81
observations	70	70	70	70

Note: # Gross national income per capita is in thousands.

Table 1 shows that the mean child mortality is 57.08 per 1000. The minimum is about 20 and the maximum is 97 per 1000. The mean gross national income per capita is about 6 $. The minimum and maximum values are 2.15 $ and 17.8 $. The mean dependency ratio is 64, whereas the minimum and maximum dependency ratios are 53 and 81.

Figure 1 shows the graphs of child mortality, per capita gross national income, and dependency ratio. The graphs show the negative relationships between child mortality and the gross national income and positive ones between child mortality and dependency ratio.

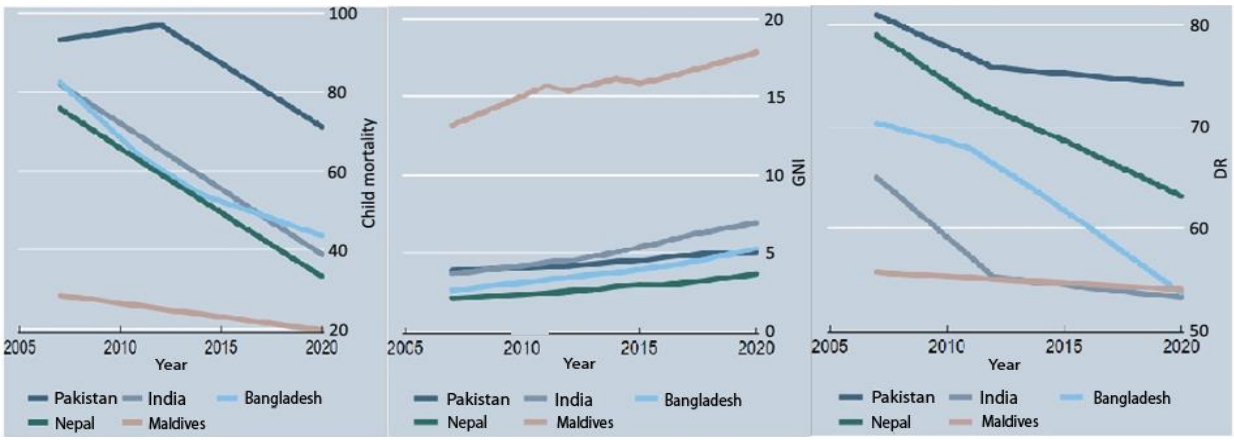

Figure 1.
Child mortality, GNI and DR.

The Figure 2a and 2b also supports the above-mentioned relationships.

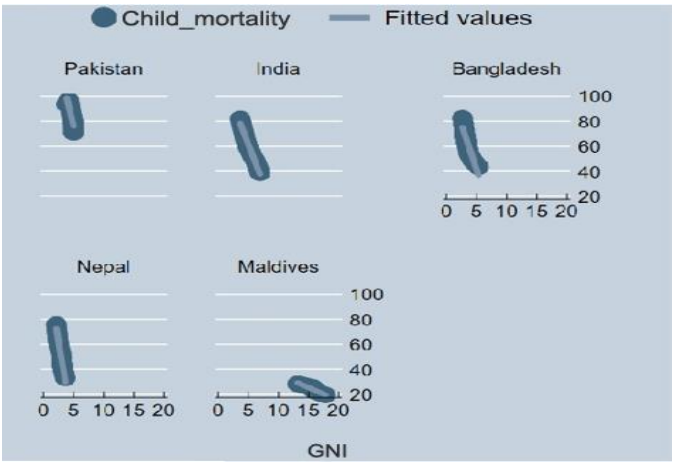

Figure 2a.
Relationship between child mortality and GNI.

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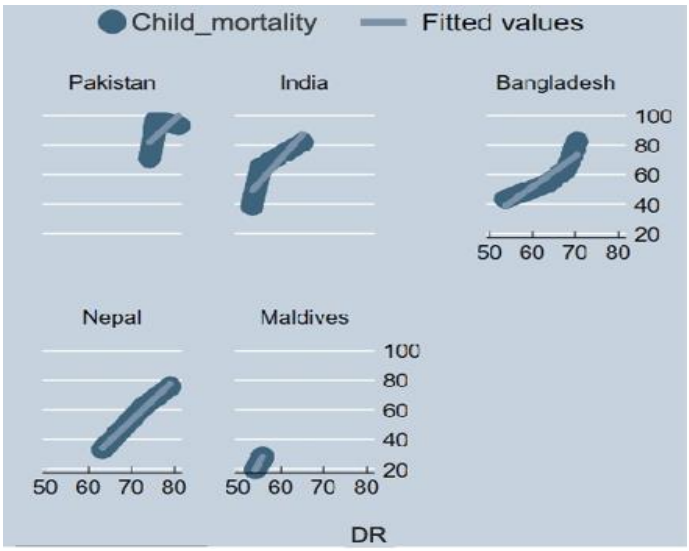

Figure 2b.
Relationship between child mortality and DR.

The results of the econometric models are presented in Table 2.

Table 2 shows that the random effect model (henceforth REM) is the preferred model (henceforth PM) based on Test of Hausman Specification to find the relationships between CM and dependency ratio. The findings depict that there is a statistically significant (henceforth SS) positive connection between child mortality and dependency ratio. One unit increase in dependency ratio brings about a 4 percent increase in CM. To lend further creditability to the results, the study also estimates Fixed Effect Model (henceforth FEM). When there is heteroscedasticity, the better choice is GLS regression. However, the study also estimates the panel-corrected standard regression to lend further credibility to the results. All these techniques also support the previous results. So, it can be said that our results are robust. These results seem very plausible. When children under the age of 15 and older individuals over the age of 64 increase, dependency ratios increase. In other words, per capita income decreases. So, households will be unable to purchase a good diet, especially for females (e.g., mothers). As a result, mothers will be facing food shortages and giving birth to unhealthy children. Further, when such households are facing a money shortage, they may not be able to get their children checked by a good doctor when their children get sick. So, there may be more chances for the children to die.

Table 2 also reveals that the PM is FEM based on the test of Hausman specification to find the relationship between CM and per capita gross national income. The findings depict that there is an SS inverse relationship between CM and economic growth. One unit increase in per capita gross national income results, in reducing CM by 19 percent in SAARC countries. To lend further credibility to the results the study also estimates the REM. The results are presented in column 3. These results also support a negative relationship between them. In the presence of heteroscedasticity, the most appropriate test is Generalized Least Square (henceforth GLS). However, the study also estimates the panel-corrected standard regression, and these results also support the previous results. All these results are consistent with those of Amonker and Brinker [17], Cruz and Ahmed [25], Kalemli-Ozcan, et al. [7], O'Hare, et al. [15], and WHO [16].

Table 2.
Estimating the roles of economic growth and dependency ratio on child mortality.

Variables	FEM	REM^	FEM^	REM	GLS	PCSE	GLS	PCSE
Constant	1.09 (5.77)	1.10 (4.42)	5.12 (53.65)	4.95 (31.28)	1.42 (5.43)	1.42 (16.25)	4.46 (90.26)	4.46 (90.53)
Dependency ratio	0.04 (7.79) **	0.04 (8.08) ***			0.039 (14.43)***	0.039 (31.27)***		
Economic growth			-0.19 (-3.38) **	-0.16 (-3.31) ***			-0.081 (-34.31)***	-0.08 (-25.37)***
F-test/BP test	171.00 (0.000)	371.43 (0.000)	79.07 (0.000)	211.57 (0.000)				
Hausman specification test	0.09 (0.7629)		11.13 (0.0000)					
Heteroscedasticity	508.56 (0.0000)	LM test: 4102.62 (0.0000) LR test: 54. 60.17 (0.0000) Wald test: 2.54e (0.000)	15.44 (0.0086)	LM test: 3626.59 (0.0000) LR test: 38.70 (0.0000) Wald test: 1.03e+05 (0.000)				
Pesaran test for cross sectional dependence		0.724 (0.47)	0.240 (0.810)					

Note: Within brackets are t-values based on heteroscedasticity corrected standard error; ** and *** are significance levels at 0.05 and 0.001, respectively; ^ shows the preferred model based on Hausman specification test; in the case of heteroscedasticity, the better choice is Generalized Least Squares (henceforth GLS) regression, especially when T is greater than cross sections N. However, the study also estimates panel-corrected standard error (henceforth PCSE) regression.

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The study also estimates the combined effects of dependency ratio and gross national income per capita on CM. The results are presented in Table 3.

Table 3.
Role of dependency ratio and economic growth on child mortality.

Variables	FEM	REM^	GLS	PCSE
Constant	2.7027 (10.97)	2.6139 (9.59)	3.0405 (12.05)	3.040 (22.91)
Dependency ratio	0.0290 (10.12)***	0.0297 (10.51)***	0.0198 (5.72)***	0.0198 (11.18)***
Economic growth	-0.0983 (-7.83)***	-0.0912 (-7.71)***	-0.0585 (-9.04)***	-0.0585 (-25.64)***
F-test/BP test	151.76 (0.0000)	289.46 (0.0000)		
Hausman specification test	3.52 (0.1724)			
Hetero	12.60 (0.0000)	LM test: 4933.68 (0.0000) LR test: 54.008 (0.0000) Wald test: 2.46e (0.000)		

Note: Within brackets are t-Statistics based on robust standard errors. *** are significance levels at 0.001, respectively, and ^ shows the preferred model. Based on the Hausman specification test, in the case of heteroscedasticity, the better choice is GLS regression, especially when T is greater than cross sections N. However, the study also estimates panel-corrected standard error regression.

Table 3 reflects that there is an SS inverse relationship between CM and EG holding the effects of the dependency ratio. One unit rise in per capita gross national income results in reducing CM by 9 percent, holding the effects of the dependency ratio in SAARC countries. Further, the results reveal that there is a statistically significant positive relationship between CM and the dependency ratio holding the effects of EG. One unit increase in dependency ratio brings about a 2.9 percent increase in CM.

4. Conclusion and Policy Implications

Child mortality is a problem in developing nations like the SAARC countries. The factors influencing child mortality are examined in this study. Panel data approaches are used for this purpose. The findings show that the dependency ratio and CM have a statistically significant positive association. Additionally, the data show that child mortality and EG have an SS-inverse connection. While keeping the impacts of the other constant, the combined effects of these factors are also evaluated. The findings show that, when the effects of the dependence ratio are held constant, there is an SS negative association between economic growth and child mortality. On the other hand, while maintaining the effects of economic growth constant, there is a statistically significant correlation between CM and dependency ratio. It is implied by policy that measures to reduce dependency ratios and increase economic growth ought to be put into place.

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Competing Interests:
The authors declare that they have no competing interests.

Authors' Contributions:
All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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