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The Link Between Life Expectancy, Infant Mortality Rate and Health Expenditure: A Global Perspective

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ABSTRACT

Life Expectancy is the average time any person is expected to live. It is a major indicator of the population's health in the world. Its value depends on two aspects which are infant mortality rate and health expenditure. Infant Mortality Rate is the number of children who die under the age of 1 year. It is a very important indicator of maternal health as health of the mother determines the chances of the child's survival. Health expenditure refers to the total amount of money spent on providing healthcare services in the country. It is a method of strengthening the human capital and productivity of the labour force. This paper uses regression in order to establish a negative relationship between IMR and life expectancy and a positive relationship between Health Expenditure and life expectancy. The results have proved to be significant. High infant mortality rates result in lower values of life expectancy. As expenditure on health increases, the life expectancy also increases due to better healthcare provisions.

Keywords: Estimated, Health spending, Infant mortality Rate, Life expectancy, Regression

Introduction

Ever since civilization began in the world, utmost importance was given to people's health. According to the theory of Charles Darwin, the organisms who are the fittest have the greatest chance of survival as well as reproduction as they are healthy and well-adjusted to the environment. To assess the health of any population in the world, the key metric always used is Life Expectancy. Considering the world's population size, it would be the broadest measure possible as it evaluates the mortality along the entire life span of the human being. Summarization of the mortalities allows easy comparisons and analysis of individual countries

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development levels. It describes the population conditions so well that United Nations Development Program (UNDP) has deemed it as an indicator for Human Development Index (HDI). Having a long and healthy life determines the social progress of every country.

This paper discusses two factors which contribute majorly to life expectancy. They are Infant Mortality Rate and Country wise Health Expenditures.

According to United Nations Projections, the current infant mortality rate in the world is 26.052 deaths per 1000 live births. The importance of this statistic is that it measures a child's survival capacity. It reflects on the wellbeing of mothers as their health during the entire duration of the pregnancy majorly determines the how healthy the child is. Maternal health in terms of nutrition, mental strength and positive outlook will ensure that the baby is fit and fine. IMR is a very sensitive indicator as its value talks about infant deaths which at the end will affect the health of the next generation. It is used widely to identify vulnerable populations so that they can be provided adequate health facilities especially during those 9 months. The lifestyle conditions of these children in terms of society, finances and surroundings are represented by this indicator.

In order to manage a country's health, there is always a monetary need. This will be the money, which is required in creation of health centres, hospitals, educational institutions for teaching and training medical practitioners and maintenance of these provisions. In all countries it is the government which mainly takes the responsibility of giving the money for this task. Citizens also play a huge role in contributing towards this as ultimately it is for their own benefit. Health expenditure or spending is a way through which there can we improvement in human capital. With better health infrastructure, there will be enhanced productivity from the people working which will add to strengthening of the economy as a whole. The spending is basically the support given for the implementation of health policies in the world which maintains the development. With the recent pandemic, overall health expenditures have increased substantially all over the globe as there was a greater demand for new equipment such as PPE kits, masks, sanitizers etc.

Literature Review

Life expectancy depends on both infant mortality rate and health expenditure, but the kind of dependency has to determined. Over the years a lot of past research has been done on these topics and significant results have been observed.

A.M Fazle Rabbi studied the effect of infant mortality on life expectancy at birth in the country of Bangladesh using time series data from the year 1975 to 2010. He used the method of life tables in order to measure the trends in both these variables. The results of the study showed that higher the infant and child mortality rates, lower is the value of life expectancy at birth (479-486). Goran Miladinov investigated the effect of socioeconomic development on life expectancy

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at birth in EU accession candidate countries by utilising aggregate time series data for the period 1990-2017 and Full Maximum Likelihood Estimation method (FIML). It was found that when infant mortality rate decreased, life expectancy appeared to have increased implying low values of infant mortality led to higher life expectancy at birth. This suggested that longevity of people in these countries was increasing (1). A critique of a Manhattan Institute paper on 'Why has Longevity Increased More in Some States than Others?' by Dean Baker and Adriane Fugh-Berman stressed that there was no adjustment for Infant Mortality in that paper. It argued that death rates at younger ages have the greatest impact on life expectancy and this was ignored in the study conducted. There were also statistics stating how plunging infant mortality rates increase life expectancy (678-679).

Research done in China by Hui Liu and Kaiyang Zhong showed that growth in health spending has a positive impact on health parameters such as life expectancy. The study adopted a Vector Error Correction Model in its analysis of these variables. It also proposed that government should as a result allocate more funds to healthcare (1-6). Murad A Bein and others conducted analysis in East African countries which revealed that there is a positive relationship between healthcare expenditures and life expectancy of both genders. The proof used Fixed effect method of regression across cross-sectional as well as time series. The result is that investment in private healthcare is essential for better health outcomes (247-252). An article in the Procedia Economics and Finance journal by Elisabeta Jaba and others revealed that for developed countries, significant increases in health expenditures led to increases in longevity. The study used data of 175 countries over a period of 16 years from 1995 to 2010 which means it was a cross country as well as time series analysis. It called for health policies that should aim at reducing health inequalities in the world (110-114). Chhabi L. Ranabhat and others did a multi-country cross-sectional study which showed that provision of universal health coverage (UHC) improves life expectancy. Data of all 193 UN member countries was taken from different sources for the period 2010/12 and analysed using record linking theory.

Developed countries have higher incomes and therefore better capacity to spend on healthcare. They also have fewer cases of infant deaths due to their clean environments. Both these conditions lead to a better chance of living long when compared with people who live in developing countries.

Data Source and Methodology

The data for this study has been taken from the World Bank database. From the entire list of countries, a sample size of 89 countries has been taken as the data for these countries were uniformly available in the database. The study involves the use of three variables namely life

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expectancy at birth as the dependent variable and both infant mortality rate as well as health expenditures as explanatory variables.

The variables are being analysed using regression analysis which basically examines the relationship between the explained or dependent variable and one or more independent or explanatory variables. Since the analysis is being done on a sample taken from a population, the estimation of the parameters is being carried out using the Ordinary Least Squares (OLS) method. All the analysis is being performed by R software.

In the equation form:

$$LE_i = \beta_1 + \beta_2\, IMR_i + \beta_3\, HE_i + u_i \qquad (1)$$

Where $Y_i = LE_i$ = Life Expectancy of ith country (in years)

β_1 is the Intercept coefficient

β_2 & β_3 are the Partial Slope coefficients

$X_{2i} = IMR_i$ = Infant Mortality Rate of i^{th} country (per 1000 live births)

$X_{3i} = HE_i$ = Health Expenditure of i^{th} country (as current % of GDP)

u_i = random error term / stochastic error term

On the basis of past research and studies conducted on these variables, the expectations of this paper are that there will be a negative sign between life expectancy and infant mortality rate while there will be a positive sign between life expectancy and health expenditures of different countries.

Regression Results

Variable	**Estimated Coefficients**	**Signif. Codes**	$\boldsymbol{R^2}$ = **0. 8735** $\boldsymbol{\bar{R}^2}$= **0. 8706**
Intercept	76.54661	***	
IMR	-0.34989	***	
HE	0.38600	**	

*Significance Codes: 0 '***', 0.001 '**', 0.01 '*', 0.05 '.', 0.1 ' ', 1*

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The estimation results of equation (1) are given in the above table. The coefficients have the signs which match with the apriori expectations of the study.

There is no heteroscedasticity in the data as the Breusch-Pagan test statistic has a high p value of 0.68 which implies that null hypothesis is not rejected. The Jarque Bera test statistic also has a high p value of 0.30 which means it does not reject the null hypothesis and that u_i is normally distributed for the sample. The F test statistic is highly significant as it has a very low p value of 0.00002 which shows R^2 is statistically significant.

The intercept of the regression model is positively related to life expectancy. This means that estimated mean number of years of life expectancy is 76.54661 if all the independent variables are kept constant.

The coefficient of Infant Mortality Rate is negative and significantly different from zero which means that it unfavourably impacts life expectancy. As IMR increases by 1 per 1000 live births, the estimated mean number of years of life expectancy decreases by 0.34989 holding all other variables constant. This could pose to be a major problem for the world as it might result in extinction of the human race. It is therefore highly necessary to have a system that is focused largely on child and maternal nutrition so as to try and bring down the IMR in the world and ensure continuation of the human species.

The coefficient of Health Expenditures is positive and significantly different from zero which means that it has a favourable impact on life expectancy. As health expenditure increases by 1% of the GDP, the estimated mean number of years of life expectancy increases by 0.38600 holding all other variables constant. Increased funding in healthcare sector undertaken by countries leads to better medical facilities and services available to the public. As a result, there is improvement in human health and they are able to live longer and happier. Better health also increases peoples' efficiency which can help innovate new technology that can further economic development.

The coefficient of determination R^2 shows that 87.35% (approximately 87%) of the total deviation in life expectancy is explained jointly by infant mortality rate and health expenditure. Even after adjusting for the degrees of freedom, the goodness of fit is high as adjusted R^2 is 87.06%

Conclusion

This paper examines the relationship between life expectancy, infant mortality rate and health expenditure using regression analysis. The study was carried out on a sample of 89 countries using R software whose data was taken from the World Bank database. Life expectancy was

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taken has the dependent variable and infant mortality rate as well as health expenditure were taken as independent variables. Through the analysis few conclusions were drawn. Firstly, there exists a negative relationship between infant mortality rate and life expectancy at birth. This means that if more number of children die under the age of 1 then longevity of an average person's life is reduced. Secondly, there is a positive relationship between health expenditures and life expectancy at birth. This means that an increase in healthcare spending by the government of any country can raise their citizen's ability to live longer. Both low infant mortality rate and high health expenditure give value to the duration people survive in the world.

Limitations

This paper uses data relating to life expectancy, infant mortality rate and health expenditure as a current % of GDP instead of per capita due to inconsistencies in the latter values when used along with infant mortality rate for regression. A more comprehensive analysis could have been carried out by adding more explanatory variables such as GDP of the country, nutrition levels of the people, environmental conditions like pollution and educational levels of the people. The study could have been made more specialised by examining the values of the variables continent wise or area wise.

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