Health and Its Impact on Economic Growth in India – An Explanation

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Abstract: This paper attempts to examine the relationship between health and economic growth in India over the years 1961 - 2015. Economic growth is measured using Gross National Income (GNI) per capita and health status is measured using Life Expectancy Rate, Infant Mortality Rate, Under-five Mortality Rate and Total Fertility Rate. The above relationships are measured using a multivariate framework controlling for other background variables. Thus, I have modeled the macroeconomic impact of health. A theoretical framework has been developed to model this linkage between health and economic growth in India and this is further tested using a regression model, which tests the causality between these variables of interest. I have found that if OLS (Ordinary Least Square) is used then there is no significant relationship between health status and economic growth, but using 2SLS (Two Stage Least Squares) the study finds highly significant effect of health indicators on economic growth in India.

Key Words **- Health, Economic Growth, Population Growth, OLS, 2SLS** ***Jel Classification*****: 112, C21, 040**

I. INTRODUCTION

It has been seen that health status is crucial for economic growth and good health is a necessary element for the human to provide labor services. Improvements in health may be as important as improvements in the economy in thinking about development and human welfare. Good health can be thought of as a goal in its own right independently of its relationship with growth. When people are healthy and educated, they are more active and enthusiastic in their work and they can become more productive in their field. This is quite obvious and widely accepted.

The essence of human capital is now widely considered as being very vital in this regard. We know that the total output of an economy depends on the levels of human capital and the stocks increase as a result of higher levels of health status, better health education, and new learning and training procedures with a good healthy, mental and physical condition. Without a labor force with some minimum levels of health, health education and health status, a country undermines its capacity of maintaining a state of continuous growth (Lopez-Casasnovas, Rivera and Currais, 2005; Halder et, 2010). This concept of human capital gives emphasis on health, health education, job training, migration and other investments on human capital which enhance the productivity of an economy.

Most of the growth economists have previously ignored this relationship of health human capital on economic growth. But at present there are a number of interests towards the research to examine the relationship between health indicators and economic growth. This link between health and economic growth is important for policy purposes. It is our aim in this current analysis to examine this relationship. The general trend is that better health will lead to better growth outcomes. We will check if it is the case in the Indian scenario as well. Thus, the greatest challenge of the ongoing twenty-first century is to provide every human being on the planet with a long, healthy and fulfilling life, free of poverty and full of opportunities to participate in the activities of their community.

So, my main objective in this paper, is to answer the research question, *"Whether the notion of health status affecting economic growth is valid for India or not??"*

II. LITERATURE REVIEW

People living in poor countries are much less healthy than people living in rich countries. This analysis contributes to the growing body of literature on health and economic growth, health and economic development and the relationship between health and income inequality. This is important for evaluating policies aimed at improving health in developing countries like India.

Health in different countries of the world at different time periods is positively related with socio-economic status (Berkman, 1988; Marmot et. al, 1991; Deaton and Paxon, 2001). The status of health of a country affects its economic growth through various channels. When there is an improvement in health, the country is able to produce more output with any given combination of skills, physical capital and technological knowledge. This has been investigated incorporating the endogenous growth model (Barro, 1991; Mankiw, Romer and Weil, 1992; Halder, 2010).

It has found that there is a strong relationship between per capita GDP health expenditure and per capita income (Selvaraju,

1994). Mayer (2001) has used the probability of adult survival by gender and age group as a measure of health status. By using Granger Causality test he has stated that health status causes economic growth in Latin America, Brazil and Mexico. He has explained that improvements in adult health are associated with 0.8-1.5% increase in annual income.

Good health is a necessary element for the human to provide labor services as shown by Zon (2001). He finds that old age people demand for health services negatively affect the economic growth. Weil (2005) uses microeconomic estimates of the effect of health on individual outcomes to construct macroeconomic estimates of the proximate effect of health on GDP per capita or economic growth. It has been studied with the help of various household indicators of adult nutrition and health, that there is a positive impact of health on total factor productivity (Schultz, 2001). In this study, it has been inferred that, third world countries have shortage of resources for investment in health while poor health status slows down the acceleration of economic growth.

In India, the longitudinal study on the relationship between health, income, and health expenditure is very few and far between. Using time series data set from 1974-75 to 1990-91 across the 15 major states in India, Reddy and Selvaraju (1994) have found that there is a strong relationship between per capita health expenditure (public) and per capita income and that health care expenditure is elastic to changes in income. Bhargav (2001) has shown a positive relationship between adult survival rate and economic growth. His result shows similar when adult survival rate is replaced by life expectancy. He has mentioned that when fertility rate is replaced by life expectancy, the fertility rates have a negative relationship with economic growth. Because he has mentioned that life expectancy is extremely influenced by the child mortality, the growth in work force is mostly lower than population growth. Resultantly high fertility growth reduces the economic growth by putting extra burden in scarce resources.

It can be shown that percentage health expenditure causes infant mortality rate while life expectancy at birth has a unidirectional relationship with percentage health expenditure. The percentage health expenditure also has a unidirectional relationship with per-capita income according to Malick (2015). His results also showed that life expectancy at birth has a unidirectional relationship with infant mortality rate and while life expectancy at birth reveals a unidirectional relationship with percentage health expenditure, the result also puts that there exists a unidirectional relationship of infant mortality rate to percentage health expenditure. He concludes that an owner of the household will be more enthusiastic in his work if the children in his family are healthier into some extent. According to him the govt. expenditure on health is an impetus input to increase child health also in terms of infant mortality rate and the increase in percentage of health expenditure causes high life expectancy rate, which influences people to become more efficient for any kind of skill work.

III. DATA TRENDS IN GNI PER CAPITA AND HEALTH INDICATORS

Data for this study is obtained from the World Development Indicators (WDI) data files provided by World Bank in their official website *data.worldbank.org* for the year 2017. The data which I am using are arranged yearly starting from 1961. The final dataset has data for 55 sample years viz. 1961 to 2015.

The Gross National Income per capita is seen to show an upward rising trend (see Figure 1). The Life Expectancy of the population is also seen to be consistently rising through the late 1960s & 70s and follows a similar pattern till now (see Figure 2). The Infant Mortality of the population is seen to be consistently declining along the years (see Figure 3). The Under–five Mortality and the Total Fertility rates also follow a similar pattern and are seen to be declining along the years (see Figures 4 and 5). The Population Growth rates however increases at first up to the mid-1970s then decreases up to 1979. Again, in the early 1980s it increases till 1983. Then it again starts declining along the years (see Figure 6).

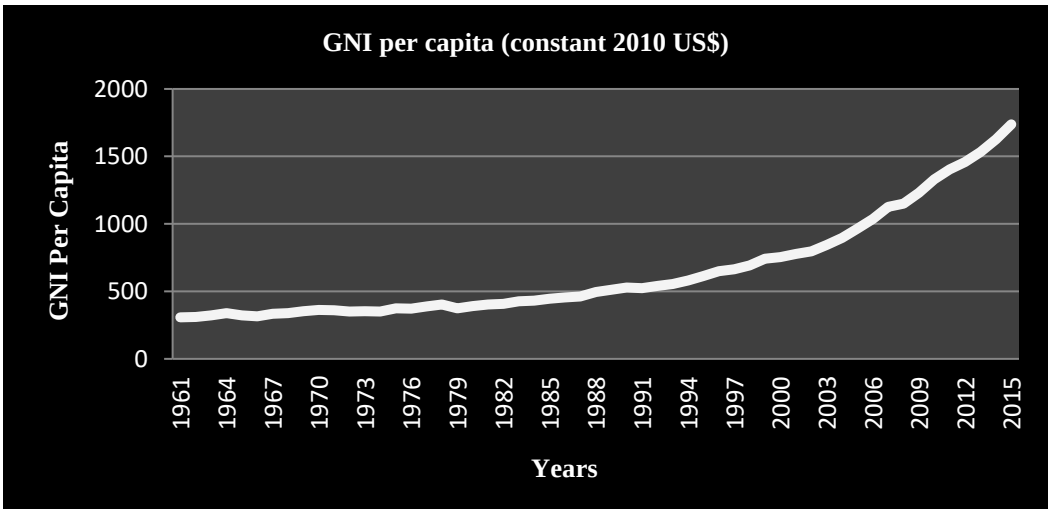

Figure 1: Trends in GNI Per Capita: India

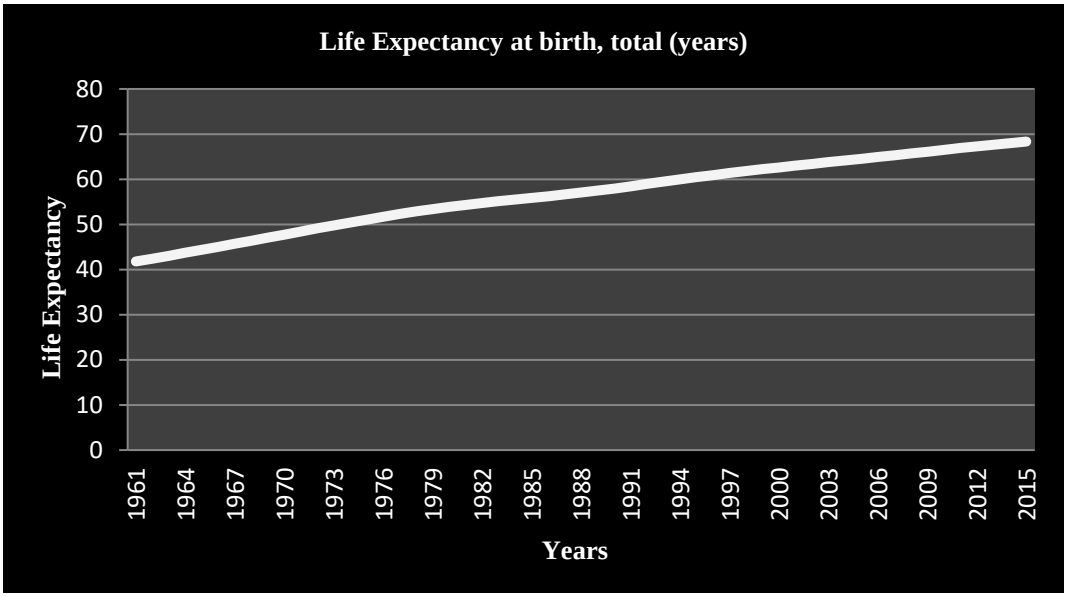

Figure 2: Trends in Life Expectancy: India

Figure 3: Trends in Infant Mortality: India

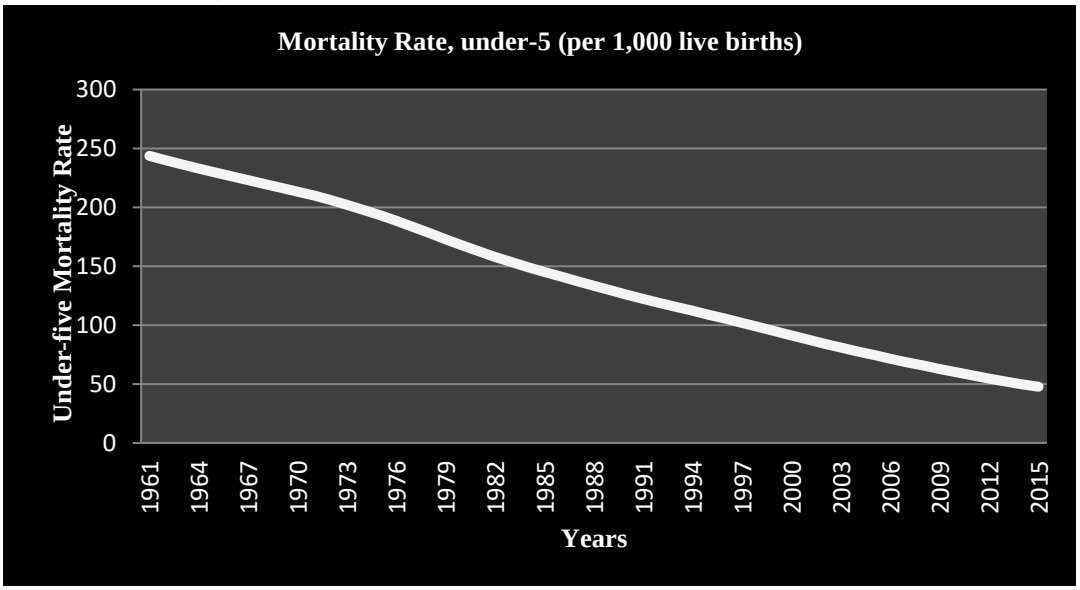

Figure 4: Trends in Under-five Mortality: India

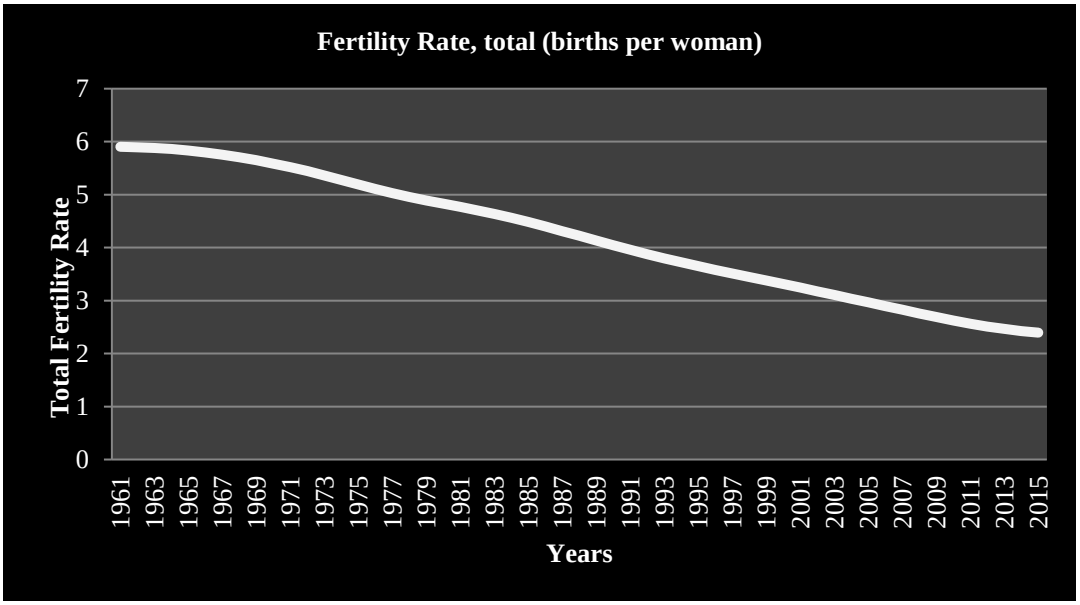

Figure 5: Trends in Total Fertility: India

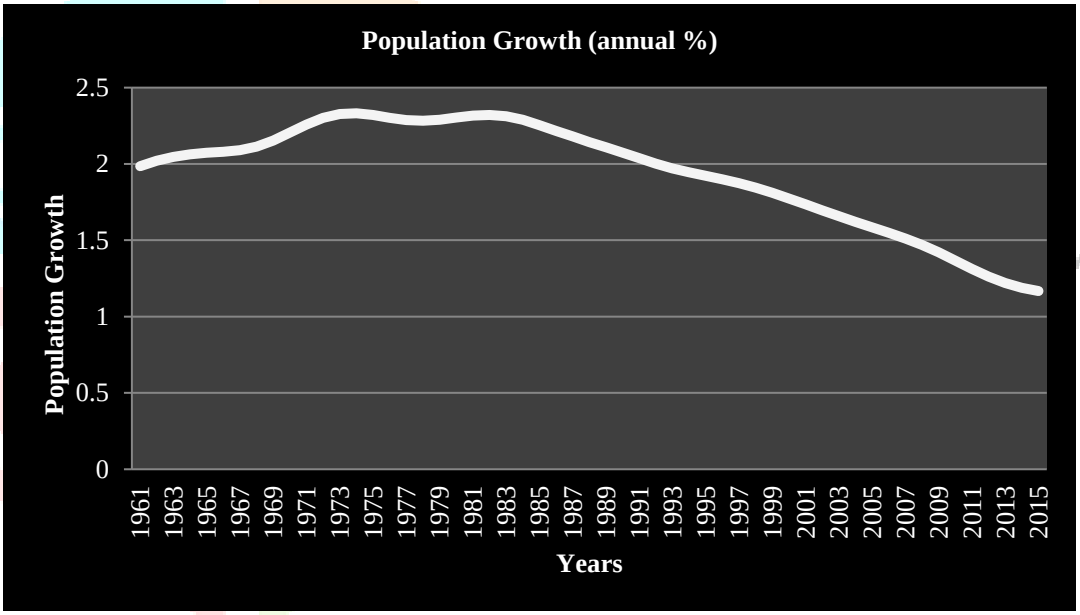

Figure 6: Trends in Annual Population Growth: India

IV. HEALTH AND GROWTH – THEORETICAL MODEL

It was Solow (1966) who gave the first model in the area of growth. Some studies use total factor productivity as the dependent variable in order to examine the impact of poor health on total factor productivity. There are other studies which use data on three of the most common causes of ill health in developing countries, one of which is the undernourishment or malnutrition. Models such as Bloom and Sevilla (2001) use growth in inputs (physical capital, labor and human capital) and growth in total factor productivity. However, in this study, we examine *Gross National Income per capita* in the model instead of total factor productivity. The health indicators used are *Life Expectancy rate, Infant Mortality rate* and other health status indicators like *Under-five Mortality rate*, *Total Fertility rate*, instead of using undernourishment directly.

According to Barro and Sala-i -Martin (1995), a nation's economic growth is dependent on the current gdp and the gdp in steady state:

$$Dy = f(y, y^*) \qquad \textit{(Equation 1)}$$

where Dy is the rate of growth of gdp;
y is the current gdp;
y* is the steady state gdp.
Dy is declining in y and increasing in y

This follows from the diminishing returns to capital. An implication of this model is that as y increases the rate of growth

will be lower in the long run in the absence of new innovations and ideas and technology not being constant. According to this model the countries which start at low levels of initial gross national income will be on higher growth paths as compared to the countries which are at higher levels of initial income. Thus, countries which have less capital per worker tend to have higher rates of return and higher growth rates. In the neoclassical model as well, the concept of capital is broadened to include human capital in the form of education and health for a broader definition of capital. These models also predict that growth must eventually cease unless there are improvements in technology.

The endogenous growth theories introduced by Aghion and Howitt (1992) do however predict that growth rates can be sustained in the long run due to technological advances resulting from R&D activity. As long as new ideas and new innovations are generated, the economy will continue to have positive growth rates. For given values of the steady state y* for a developing country, a higher starting level of per capita output y implies a lower per capita growth rate. We can also see that the correlations between the level of gross national income and growth rates are not high.

4.1 Variable Description

The literature on economic growth has firmly demonstrated the role of health in influencing economic outcomes. It is suggested that, all things being equal, healthier workers are more likely to be able to work longer, be generally more productive than their relatively less healthy counterparts, thus able to secure higher earnings than diseased-ridden workers. Now I want to depict the role of health in influencing economic growth in India over the years through a regression analysis. The variables which I have taken into consideration are the following,

4.1.1 Dependent:

***GNI per capita (constant 2010 US$)*:** GNI Per Capita is a proxy for economic growth. It is nothing but the gross national income divided by midyear population. GNI (formerly GNP) is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. Data are in constant 2010 U.S. dollars.

4.1.2 Independent:

***Life expectancy at birth, total (years)*:** Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.

***Mortality rate, infant (per 1,000 live births)*:** Infant mortality rate is the number of infants dying before reaching one year of age, per 1,000 live births in a given year.

***Mortality rate, under-5 (per 1,000 live births)*:** Under-five mortality rate is the probability per 1,000 that a newborn baby will die before reaching age five, if subject to age-specific mortality rates of the specified year.

***Fertility rate, total (births per woman)*:** Total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year.

***Population growth (annual %)*:** Annual population growth rate for year t is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.

4.2 Empirical Estimation

First, we describe the data using summary statistics (see Table 3) and simple linear regressions (see Table 5) and correlations of GNI per capita with other variables (see Table 2). The correlation matrices reinforce the findings of the scatter diagrams (shown below). Assume that our structural (or causal) equation of interest is the following. In the empirical specification, a linear regression method is used to examine the effect of the health variables on gdp per capita growth (see Table 1). The system of equations is:

$$Y = \alpha + \beta . S + \varepsilon \qquad \textit{(Equation 2)}$$

where Y is gross national income;
S is the measure of health;
ε is the unexplained variation.

We have taken the health indicators as *Life Expectancy at Birth, Infant Mortality, Under-five Mortality and Total Fertility rate.*

Therefore, Equation 1 is the theoretical model and Equation 2 represents the empirical equation we need to estimate. β represents the causal effect of S on Y. We aim to get an unbiased estimate of β. A sufficient condition for OLS to yield an unbiased

estimate of β is that the conditional expectation of ε given S is zero i.e. E (ε | S) = 0. Thus, ε and S must be uncorrelated. However, this assumption can be violated under two conditions. First, there may be reverse causality. If Y also causes S then ε will be correlated with S as the other factors causing Y must be working through ε. Second, if both Y and S are caused by a third factor—for example, X—then the influence of X must be captured by ε. This also implies a correlation between ε and S. Third, if the variables are measured with error, this will also induce correlation.

We estimate this equation using a *two-stage least squares estimation* in reduced form since the *linear regression method* and *three-stage least squares estimation* would give inconsistent estimates.

The solution of this problem is to apply an *Instrument Variables* approach. The idea is to find one or more variables—the instruments—which are correlated with S and are uncorrelated with ε. Then we need to use these instruments to get an unbiased estimate of β. The way to do this is to first regress S on X and then uses the predicted values of S from this regression instead of the original values of S in the regression of Y on S. The intention for this approach is as follows: By using the predicted values of S from a regression on X, we use only that part of S which is explained by X, and which we know is not caused by the factors working through ε. In the second stage, if we find a correlation between Y and the predicted S from stage 1, then we can attribute this to the effect of S on Y.

We can see that GNI Per Capita is only positively correlated with Life Expectancy at Birth and is negatively correlated with all the other health indicators (see Table 2).

The results from the Ordinary Least Square (OLS) and the Two-Stage Least Square (2SLS) regressions are given in Table 4 and 5. The R^2 value for both the OLS and 2SLS model suggests that approximately 98% of the variation in Y is explained by the explanatory variables. Here R^2 is 0.9763 and 0.9756 for OLS and 2SLS respectively. Therefore, overall both the models are good fit (see Table 4).

We can see that, only the OLS coefficients of Infant Mortality and Under-five Mortality are significant at 1%, 5% level of significance. All the other health variables are found to be insignificant implying that health does have little or no impact on economic growth whatsoever (see Table 5).

However, when we run the Two-Stage Least Square (2SLS) estimation we see that all the health variables excluding Fertility Rate are highly significant at the 99.99+% level (see Table 5). Thus, we reject the Null Hypothesis **(β=0)** at 1%, 5% level of significance. Only Fertility Rate is found to be insignificant at 5% level of significance. However, it becomes significant at 10% level as P = 0.071 < 0.10 (see Table 5). So, the effects of all the health variables except Fertility Rate come out to be highly significant (above 99% level) for the 2SLS estimation. The coefficient for Infant Mortality rate indicates that a decrease in Infant Mortality would increase Gross National Income per capita by 562.91 (see Table 5).

While running the 2SLS regression we use Population Growth (Annual %) as the instrument. We can make a reasonable assumption that the population growth rate is correlated with life expectancy since the increase in population would imply that more people are growing older and have better health and improved lives thus leading to higher life expectancies. This variable may not, however, be correlated with gross national income per capita as population growth rate may not have a direct effect on gross national income. Additionally, the other health indicators can also be used as instruments since they satisfy the restriction. In this way, we have obtained the results by running the instrumental variables.

Table 1: Correlations between GDP per capita growth rate and Health Indicators

Particulars	Life Expectancy at Birth	Total Fertility Rate	Infant Mortality Rate	Under-five Mortality Rate
GDP per Capita Growth Rate	0.5180	-0.5405	-0.5320	-0.5317

Source: Results obtained from statistical software Stata 13.

Table 2: Correlation between GNI per capita and Health Indicators

Particulars	Life Expectancy at Birth	Total Fertility Rate	Infant Mortality Rate	Under-five Mortality Rate
GNI per Capita	0.88469	-0.8848	-0.8599	-0.8563

Source: Results obtained from statistical software Stata 13.

Table 3: Descriptive Statistics for select variables

Variable	Means (Standard Deviation)
Gross National Income per Capita (constant 2010 US$)	651.3573 (386.0965)
Life Expectancy at Birth, total (years)	56.59338 (7.749114)
Infant Mortality Rate (per 1,000 live births)	96.69273 (38.57358)
Under-five Mortality Rate (per 1,000 live births)	139.6509 (61.26831)
Total Fertility Rate (births per woman)	4.211545 (1.148535)
Population Growth (annual %)	1.943577 (0.3493314)
Number of Observations	55

Source: Results obtained from statistical software Stata 13.

Trends in GNI per Capita and Life Expectancy

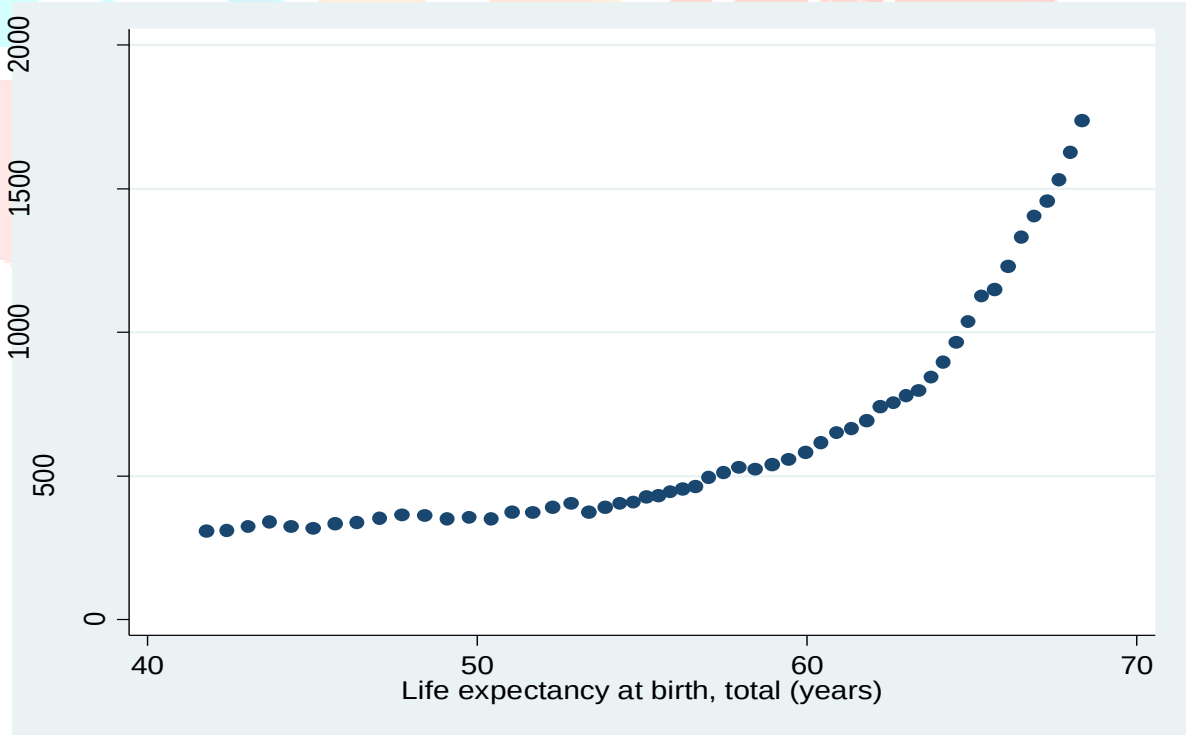

Figure 7: Gross National Income per Capita and Life Expectancy

Trends in GNI per Capita and Infant Mortality Rate

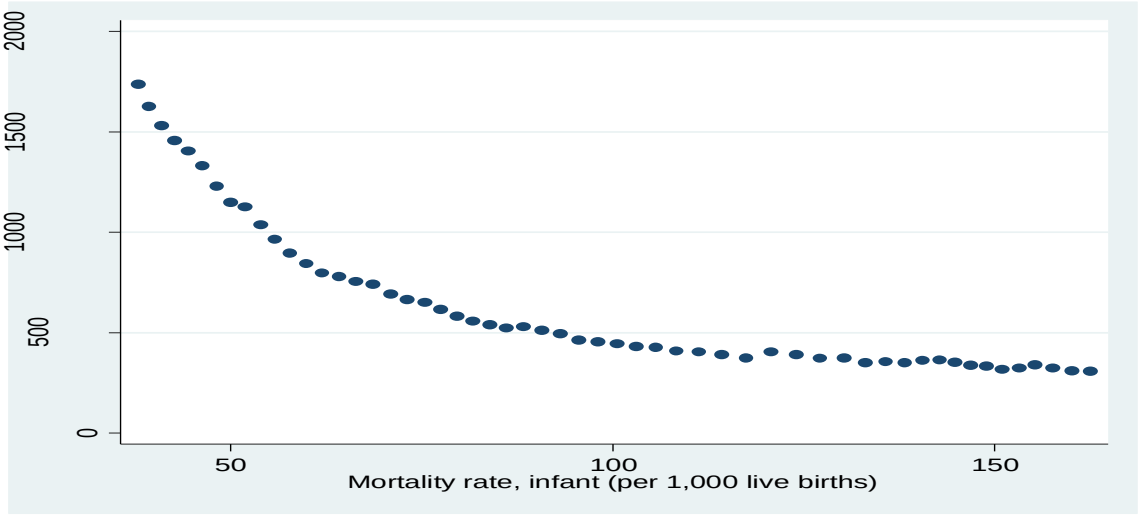

Figure 8: Gross National Income per Capita and Infant Mortality

The above figures have been obtained using statistical software Stata 13 and the data for this is obtained from the WDI. It can be seen that GNI per capita and Life Expectancy rate show an increasing trend and GNI per capita and Infant Mortality rate show a decreasing trend (see Figures 7 and 8 respectively). These graphs depict the same results as found in the correlation matrices (see Table 2).

The Tables below show the results of the Ordinary Least Square (OLS) and the Two-Stage Least Square (2SLS) regressions.

Table 4: R-Squared for OLS and 2SLS

Particulars	OLS	2SLS
Number of Observations	55	55
R-Squared	0.9763	0.9756

Source: Results obtained from statistical software Stata 13.

Table 5: OLS and 2SLS Model of GNI per capita

2SLS model for Gross National Income per Capita				
Dependent Variable: GNI per Capita				
VARIABLE	OLS		2SLS	
	Coefficient (Standard Error)	P>|t|	Coefficient (Standard Error)	P>|z|
Constant	9633.986 (5519.128)	0.087	16208.22 (1509.521)	0.000*
Life Expectancy at Birth	-55.3072 (60.2642)	0.363	-127.2322 (18.98972)	0.000*
Population Growth	-353.0339 (311.4006)	0.262	---	
Infant Mortality Rate	-422.8949 (121.6936)	0.001*	-562.9144 (41.04401)	0.000*
Under-five Mortality Rate	254.8998 (72.51632)	0.001*	337.9103 (22.31076)	0.000*
Total Fertility Rate	30.25519 (329.7265)	0.927	-265.0026 (146.5907)	0.071

Source: Results obtained from Stata 13. *Significant at atleast 5% level.

4.3 Results

The results from the OLS regressions show that the health indicators do not have a significant effect on gross national income per capita or in other words, *simple linear regression showed that health has little or no impact on economic growth in India*. Also, the correlation between the health indicators do not show high correlations between different health indicators and gross national income per capita. This is also corroborated by the regression results. But as health and income are interdependent conducting a linear regression would give inconsistent estimates since there is a problem of endogeneity. Therefore, to overcome this problem, we used a Two-Stage Least Square (2SLS) method so that this could be estimated in reduced form as given in Equation 2. Thus, the results of this study are similar to other studies which have investigated this relationship and tried to account for the two-way relationship between health and income.

To conclude, we have found **highly significant** estimates for the effect of health variables like Life Expectancy, Infant Mortality and Under-five Mortality rate while running Two-Stage Least Square (2SLS) regression. We also used other explanatory variables like Total Fertility rate and the Population Growth rate. Thus, through this paper we tried to show that "*Health do have a significant impact on Economic Growth in India*."

V. CONCLUSION

We can say that, fixing health care and fixing the economy are two sides of the same coin. As healthy people are active enthusiastic in their work, they are more likely to be working hard due to their activeness and willingness for giving more time in work. As a result, good health increases the output of an economy because healthy people are highly productive than unhealthy ones. Moreover, good health helps to forge improved levels of health education by increasing levels of schooling and scholastic performance (Schultz, 1997). Health affects total factor productivity; hence economic growth is enhanced through its impact on demographic factors. This is also true for India. We have seen from the years 1961 to 2015 health status has had a significant impact on economic growth in India.

My study and its findings can provide more value added to current studies on health and economic growth for India. India will need to improve provision of health services as well as physical infrastructure in order to lift people out of poverty and provide them with better living standards. This is important since most of the literature on growth examines education instead of health as a key determinant of income. The literature on health is still growing and government expenditure on health needs to be at the same level as education. Also since health affects economic growth initiatives should be taken to improve the health sector in India. Thus, it can be seen that any policy initiatives should be aimed at improving health services.

In this light suggested policy initiatives should be aimed at improving the health sector in India. Some of them could be the following,

1. Public health sector spending by the central and state governments are low in India. This should considerably increase.
2. In India public health services are relatively more accessible in urban areas as compared to their counterparts in rural areas, so there is need to concentrate on health policies in rural areas.
3. Health indicators are significantly related to per capita public health expenditure. Hence, in order to improve the health status, it is very important that the Indian government should raise its expenditure on health sector.

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