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A Relationship between Health and Economic Growth in India: An Explanation

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Abstract

The present study attempts to examine the relationship between health and economic growth in India from the years 1991 to 2015. Economic growth is measured using Gross Domestic Product (GDP) per capita and health status is measured using Life Expectancy Rate, Infant Mortality Rate, Under-five Mortality Rate and Total Fertility Rate. These relationships have been measured with a multivariate framework controlling for other background variables. In this way we 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 it is further tested using a regression model which tests the causality between these variables of interest. We have found that if Ordinary Least Square is used then there is no significant relationship between health status and economic growth, but using Two Stage Least Squares the study finds highly significant effect of health indicators on economic growth in India.

Keywords: *Health, Economic Growth, Population Growth, OLS, 2SLS*

1. Introduction

Health status is crucial for economic growth and good health is a necessary element for human to provide labour 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 economic 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 labour 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 & 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, our main objective in this paper, is to check *"Whether the notion of health status affecting economic growth holds true for India or not??"*

2. Review of Literature

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.
It has been found that 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 by Barro (1991); Mankiw, Romer and Weil (1992) and Halder (2010). The probability of adult survival by gender and age group has been used as a measure of health status by Mayer (2001). 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. It has been found that good health is a necessary element for the human to provide labour services. The old age people demand for health services negatively affect the economic growth (Zon, 2001). Weil (2005) used 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. With the help of various household indicators of adult nutrition and health; it has been found that there is a positive impact of health on total factor productivity (Shultz, 2005). From this it can be inferred that the third world countries have shortage of resources for investment in health while poor health status slows down the acceleration of economic growth.

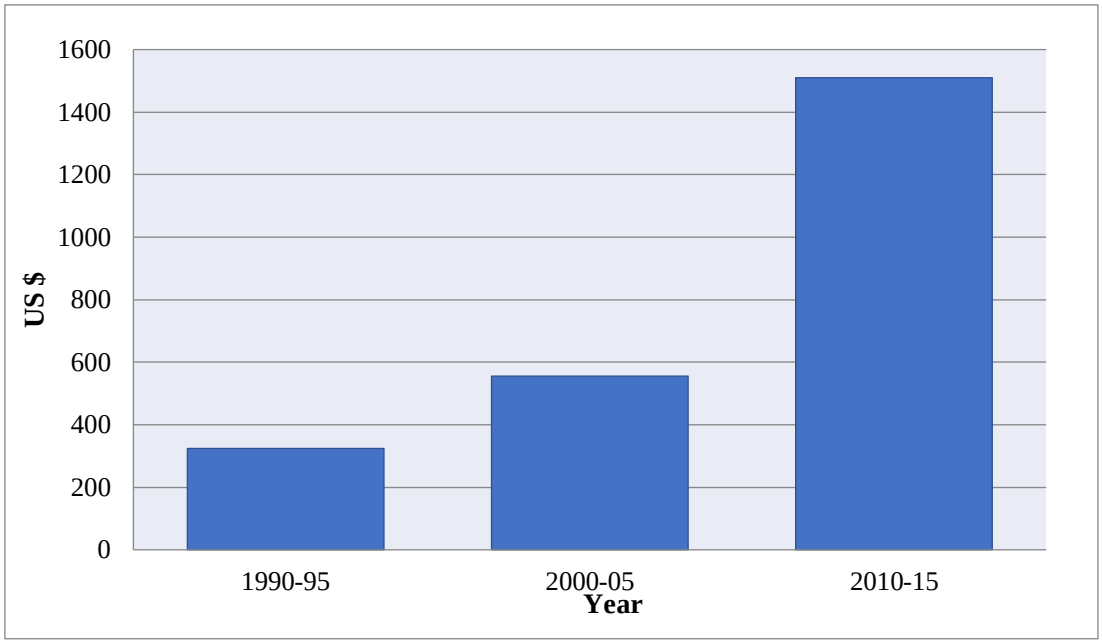
In India, the longitudinal study on the relationship between health, income, and health expenditure is very few and far between. Using time series data set from 1974-75 to 1990-91 across the 15 major states in India, Reddy and Selvaraju (1994) have found that there is a strong relationship between per 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 also has a unidirectional relationship with it. The percentage health expenditure also has a unidirectional relationship with per-capita income (Malick, 2015). His results also showed that life expectancy at birth has a unidirectional relationship with infant mortality rate and life expectancy also reveals a unidirectional relationship with percentage health expenditure and the result also puts that, there exists a unidirectional relationship of infant mortality 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. 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 health expenditure causes high life expectancy rate, which influences people to become more efficient for any kind of skill work.

3. Data Trends in GDP per capita and Health Indicators

The 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 we are using are arranged in five-yearly averages to allow time for the effects to occur and to reduce the effects of long-run disturbances due to events such as destructive weather, business cycles, election years etc. Finally, our dataset has the years, 1990-95, 2000-05 and 2010-15. The trends are given below for these years.

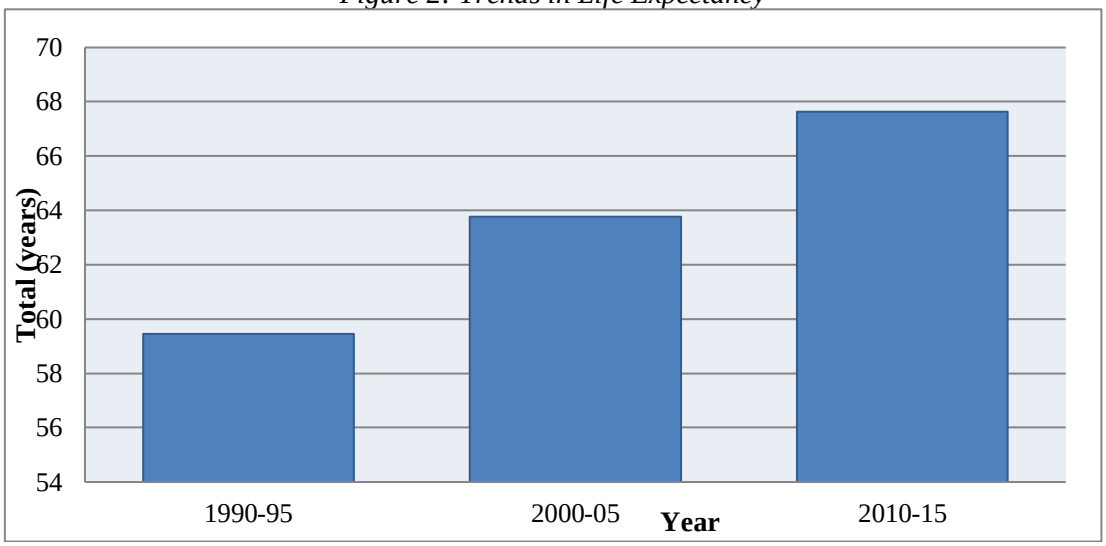
The Gross Domestic product (GDP) per capita and the Life Expectancy of the population is seen to be consistently rising into the 2000s (see Figures 1 & 2). The Infant Mortality of the population is seen to be consistently declining along the years (see Figure 3). The Under–five Mortality and the Total Fertility rates also follow a similar declining pattern (see Figures 4 and 5). The Population Growth rate is also seen to be decreasing into the 2000s (see Figure 6).

Figure 1. Trends in GDP Per Capita



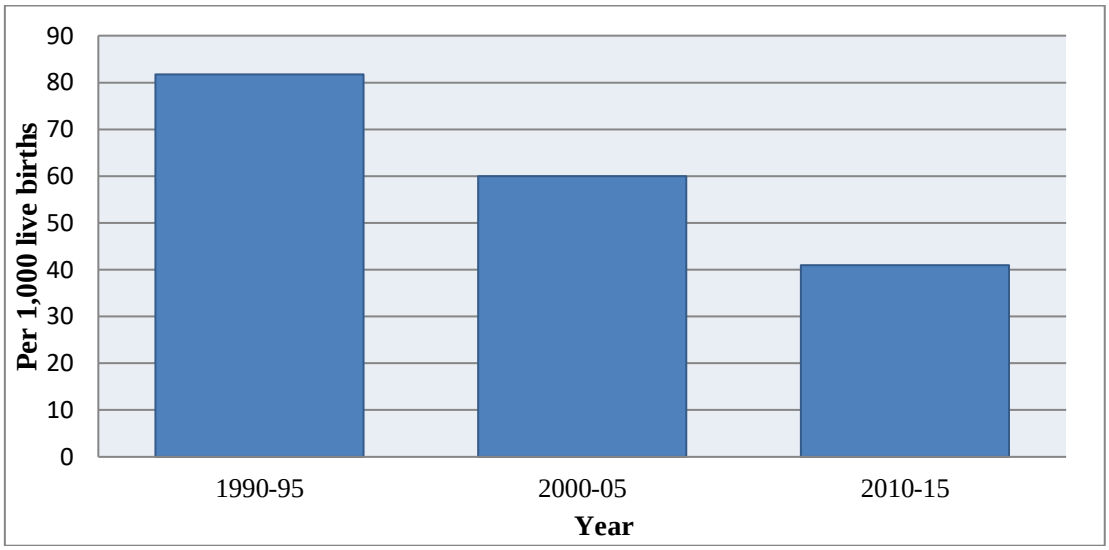
Source: Obtained using Microsoft Excel; Data from WDI.

Figure 2: Trends in Life Expectancy



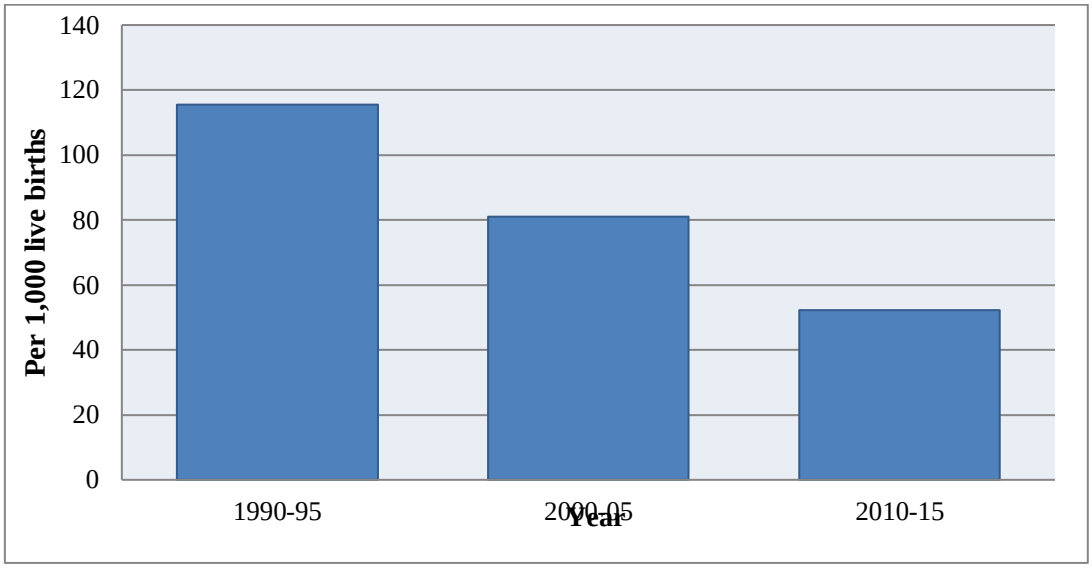
Source: Obtained using Microsoft Excel; Data from WDI.

Figure 3. Trends in Infant Mortality



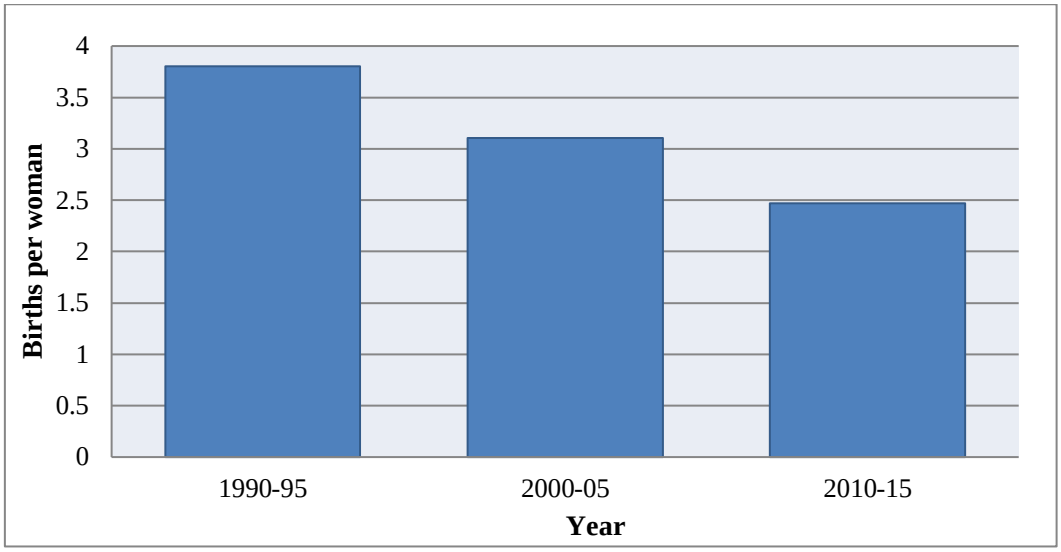
Source: Obtained using Microsoft Excel; Data from WDI.

Figure 4. Trends in Under-five Mortality



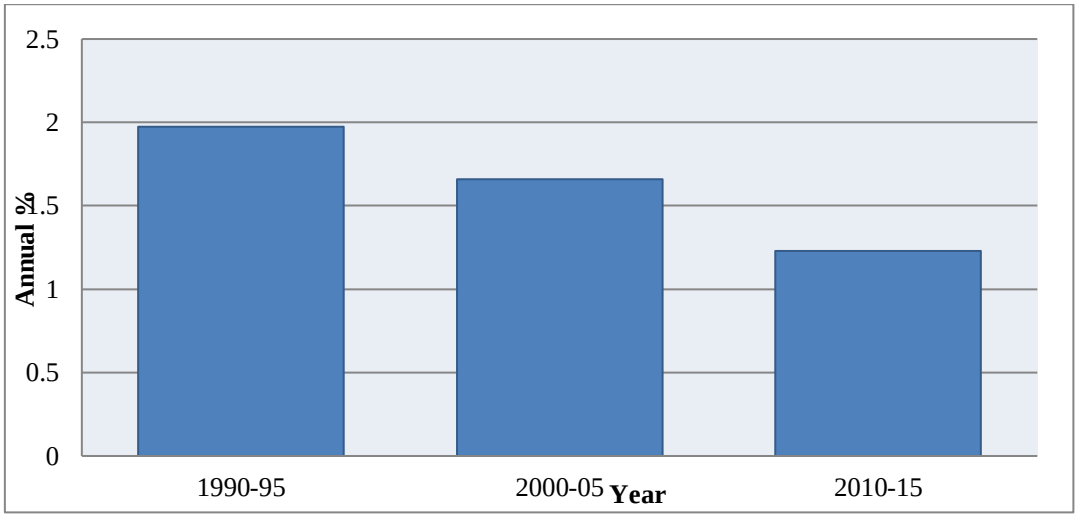
Source: Obtained using Microsoft Excel; Data from WDI.

Figure 5. Trends in total fertility: India



Source: Obtained using Microsoft Excel; Data from WDI.

Figure 6. Trends in annual population growth



Source: Obtained using Microsoft Excel; Data from WDI.

4. Health and Growth – Theoretical Model

Solow, in the year 1996 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, labour and human capital) and growth in total

factor productivity. However, in this study, we examine *Gross Domestic Product 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.

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

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

where D_y is the rate of growth of GDP;
y is the current GDP;
y^* is the steady state GDP;
D_y 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. It can also be 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 we want to depict the role of health in influencing economic growth in India over the years through a regression analysis. The variables which we have taken into consideration are the following,

DEPENDENT:

GDP per capita (current US$) [proxy for Economic Growth]: GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars.

INDEPENDENT:

Life expectancy at birth, total (years): Life expectancy at birth indicates the number of years a new-born 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 new-born 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 GDP 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:

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

where Y is gross domestic product per capita;
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 makes a cause to 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 GDP 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 0.9869 and 0.9832 for OLS and 2SLS respectively. Therefore, overall both the models are good fit (see Table 4).

We can see that, only the OLS coefficient of Total Fertility rate is significant at 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 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. As a result, the effect of all the health variables come out to be significant (above 99% level) for the 2SLS estimation. The coefficient for Infant Mortality rate indicates that a decrease in Infant Mortality would increase GDP per capita by 864.63 (see Table 5). Again, we observe that an increase in Fertility rate will reduce GDP per capita by 7230.80.

While running the 2SLS regression we use *Population Growth* rate 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 domestic product per capita as population growth rate may not have a direct effect on gross domestic product. 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	0.5318	-0.5351	-0.5313	-0.5339

Source: Results obtained from statistical software Stata 13.

Table 2. Correlation between GDP per capita and Health Indicators

Particulars	**Life Expectancy at Birth**	**Total Fertility Rate**	**Infant Mortality Rate**	**Under-five Mortality Rate**
GDP per Capita	0.9309	-0.9338	-0.9303	-0.9269

Source: Results obtained from statistical software Stata 13.

Table 3. Descriptive Statistics for select variables

Variable	**Means (Standard Deviation)**
Gross Domestic Product per capita (current US$)	771.4257 (465.0749)
Life Expectancy at Birth, total (years)	63.67137 (2.994288)
Infant Mortality Rate (per 1,000 live births)	60.732 (15.06173)
Under-five Mortality Rate (per 1,000 live births)	82.54 (23.41967)

Total Fertility Rate (births per woman)	3.11632 (0.4928791)
Population Growth (annual %)	1.633654 (0.2760284)
Number of Observations	25

Source: Results obtained from statistical software Stata 13.

We have seen from the correlation matrices that, GDP per capita and Life Expectancy show an increasing trend and GDP per capita and Infant Mortality show a decreasing trend (Table 2). These results have been shown graphically below using statistical software Stata 13 and the data for this is obtained from the WDI (see Figures. 7 and 8).

Figure 7. Trends in GDP per Capita and Life Expectancy: India

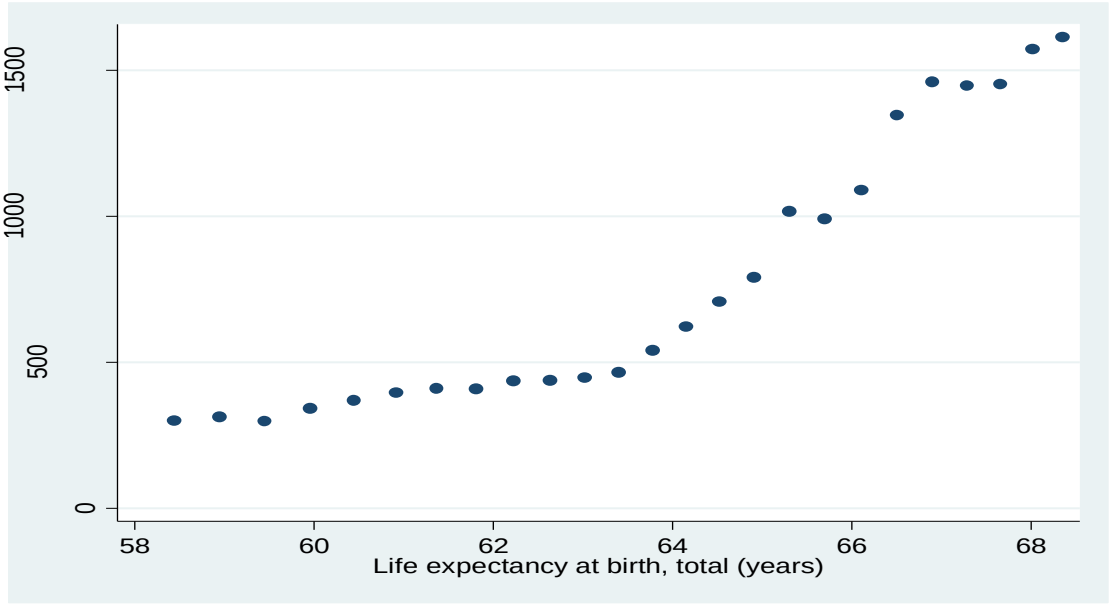
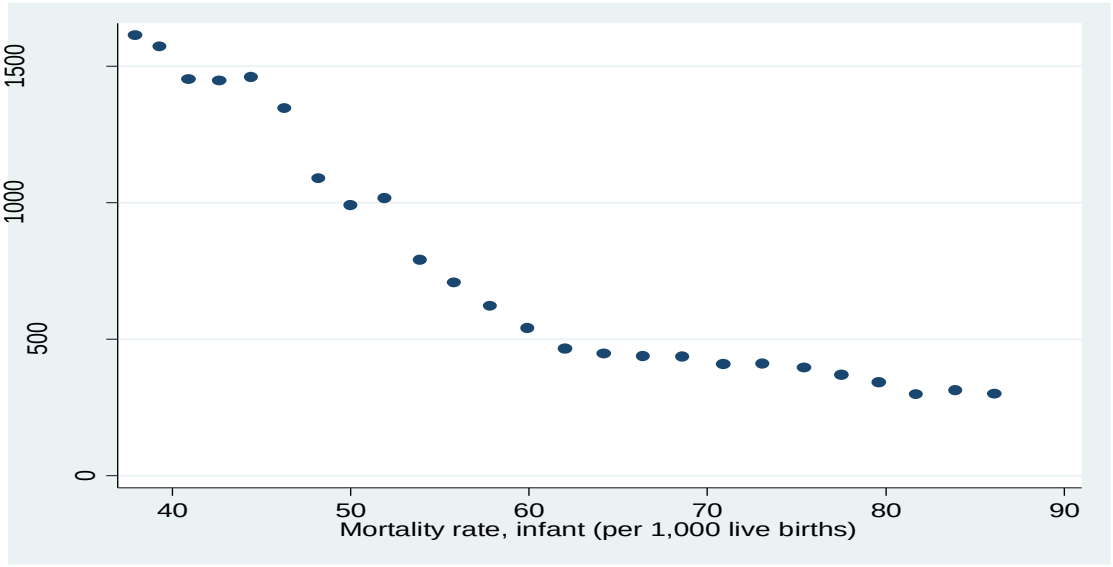


Figure 8: Gross Domestic Product per capita and Infant Mortality



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	25	25
R-Squared	0.9869	0.9832

Source: Results obtained from statistical software Stata 13.

Table 5. OLS and 2SLS Model of GDP per capita

2SLS model for Gross Domestic Product per Capita				
Dependent Variable: GDP per Capita				
VARIABLE	**OLS**		**2SLS**	
	Coefficient (Standard Error)	**P>|t|**	**Coefficient (Standard Error)**	**P>|z|**
Constant	32838.92 (18821.71)	0.097	76412.8 (12558.88)	0.000*
Life Expectancy at Birth	-276.286 (214.5058)	0.213	-775.1449 (158.0085)	0.000*
Population Growth	-2328.33 (1248.752)	0.078	---	
Infant Mortality Rate	-251.4176 (302.8055)	0.417	-864.6261 (92.81173)	0.000*
Under-five Mortality Rate	235.0472 (181.7025)	0.211	590.7089 (48.61877)	0.000*
Total Fertility Rate	-4750.473 (1524.774)	0.006*	-7230.798 (933.0626)	0.000*

*Source: Results obtained from Stata 13. *Significant at 1% level.*

4.3 Results

The results from the OLS regressions show that the health indicators do not have a significant effect on gross domestic product per capita that is to say '*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 domestic product per capita. This is also corroborated by the regression results. But as health and GDP 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 growth.

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

5. 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 1991 to 2015 health status has had a significant impact on economic growth in India.
This 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 and economic growth. 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 said that policy initiatives should be aimed at improving health services.

In this light suggested policy initiatives should focus on 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.

4. Economic growth affects health both directly as well as indirectly. Thus, economic policies should concentrate on overall economic development of the poor performing states so as to improve the health status of their inhabitants.

References

Solow, R. M. (1966). Review of capital and growth. *American Economic Review*, 56, 1257-60.

Barro, R. (1991). Economic growth in a cross-section of countries. *Quarterly Journal of Economics*, 106(2), 403–443.

Marmot, M. G. (1991)**.** Health inequalities among British civil servants: the Whitehall II study. Lancet, 337(8754), 1387-93.

Mankiw, N.G., Romer. D & Weil, D.N. (1992). A Contribution to the Empirics of Economic Growth, *The Quarterly Journal of Economics*, 107(2), 407-437.

Reddy, K.N. & Selvaraju, V. (1994). Determinants of Health Status in India: An Empirical Verification, *Indian Economic Association*, 94, Bombay.

Kelly, A.C. & Schmidt, R. M. (1995). Aggregate Population and Economic Growth. Demography, 32, 543-555.

Barro, R.J. (1997). Determinants of Economic Growth. Massachusetts: MIT Press.

Bhargava, A., Jamison, D. T., Lau, L. J., & Murray, C. J. (2001). Modeling the effects of health on economic growth. *Journal of Health Economics*, 423–440.

Zon, A.V. (2001). Health and endogenous growth. *Journal of Health Economics*, 20 (2), 169-185.

Mayer, D. (2001). The long-term impact of health on economic growth in Mexico. *Journal of International Development*, 1950–1995, 123-126.

Bloom, D.E, Canning, D. & Sevilla, J. (2004). The Effect of Health on Economic Growth: A Production Function Approach. World Development, 32.

Gyimah-Brempong, K., & Wilson, M. (2004). Health human capital and economic growth in Sub Saharan African and OECD countries. *The Quarterly Review of Economics and Finance*, 296–320.

Schultz, T. P. (2005). Productive Benefits of Health: Evidence from Low-Income Countries. *Economic growth center discussion paper*, No. 903.

Ganguly, et. al. (2005). Review of Health Care in India by Centre for Health and Allied Themes, Survey no. 2804 & 2805, 1-394

Weil, D. N. (2005). Accounting for the effect of Health on Economic Growth. National Bureau of Economic Research, Working Paper no. 11455.

Malik, G. (2006). An Examination of the Relationship between Health and Economic Growth. *ICRIER*, Working Paper No. 185.

Lopez-Casasnovas, G., Rivera, B. & Currais, L. (2007). Health and Economic Growth: Findings and Policy Implications. *The World Economy*, 30 (3).

Gujarati, D.N. & Sangeeta, G. (2007). Basic Econometrics, Tata McGraw hill, Fourth Edition.

Bloom, D.E. & Canning, D. (2008). Population Health and Economic Growth, Working Paper No. 24.

Halder, S.K. & Mallik, G. (2010). "Does Human Capital Cause Economic Growth? A Case Study of India. *International Journal of Economic Science and Applied Research*, 3 (1), 7-25.

Malick, B.K. (2015). Linkages between Health and Economic Growth in India: An Econometric Analysis. *Journal of Business Management & Social Sciences Research*, Volume 4, No.1.

World Bank. (2017). World Development Indicators, www.data.worldbank.org .