



IMPACT OF HEALTH ON WORKER PRODUCTIVITY: EVIDENCE FROM SOUTH ASIA

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ABSTRACT

Health is an essential element that enables people to spend their life with great potential. A healthy life helps to live with confidence and self-esteem. At the macro level, the key foundation of economic development is health. On the micro-level, health can efficiently ensure people's productive and gratifying life. Health affects economic growth in many ways i.e. workers' poor health causes a reduction in productivity, on the other hand, due to healthy nutrition productivity rises. The core objective of conducting this study is to investigate the impact of human health on worker productivity. The health proxies that are used in this study is life expectancy. The indicator of education is the school enrollment at the secondary level; labor force and gross capital formation are also used as independent variables. The study used a panel of South Asian countries from 1991 to 2019, by applying panel OLS, fixed-effects model, random-effects model, and generalized method of moments (GMM). The results demonstrate that health and education significantly and positively influence productivity. This study recommends that the government of every South Asian country should take essential steps and make policies regarding improvement in health status and advancement in the education system.

Keywords: Health, Productivity, South Asia, GMM

JEL Codes: I10, I20, J21, J24

I. INTRODUCTION

Worker productivity plays an important role in boosting business and raising economic growth. It is defined as the number of goods and services produced by the worker within a given period. It depends upon mental proficiency, physical capabilities, technological advancement as well as human capital investment (Jack 1999). It can be improved by investing in human capital and using advanced techniques in the production process. Human capital is the most important determinant of productivity which means the accumulation of health, knowledge, and skills (Afzal et al., 2012). Productivity increases efficiency which helps to reduce the cost of production. It is linked with variation in new technology, human capital, and physical capital (Gong et al., 2012). Human capital means the knowledge and skills which are necessary to increase productivity. When the yield is rising with static labor hours, it shows that workers are more creative, efficient, and productive (Arabi and Abdalla 2013). A higher level of education leads increasing level of human capital which ultimately boosts productivity.

Health is one of the indicators to boost productivity (Siddique et al, 2020). A healthy worker has physical and mental capabilities to work efficiently and these capabilities enhance productivity. Investment in health makes workers healthy and helps them to fight against chronic diseases. Countries having poor health conditions are difficult to attain sustained development (Soriano and Garrido 2016). A positive association exists between health and productivity (Bloom et al. 2001). Worker productivity is a key factor in economic growth. Productive firms are more profitable and generate more employment. Skilled workers are more productive and have more income and better living standards as compared to unskilled workers (Arabi and Abdalla, 2013). In an economy, health is the engine of growth as well as health is considered a capital creative asset (Barro, 1996). When the people of a country invest in education and health, they ultimately receive returns (Mushkin, 1962). According to Bloom and Canning (2000) and Grossman (1972), healthy persons are more productive as compared to unhealthy, because they efficiently acquire the knowledge and

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skills, and consequently the level of productivity rises. According to Sorkin (1976) health decreases the mortality rate and for the twentieth century the impact of health has a significant impact on growth, but for developing nations, the scenario may be different regarding the linkage between health status and economic growth. Jack (1999) identifies how health strategies impact economic growth in developing countries. Labor productivity depends upon various factors such as; mental proficiency, physical capabilities, human capital investment, labor-management efficiency, and health improvement. Advancement in health means increasing worker life expectancy. The way of economic growth and socio-economic transformation can be improved or slowed down by health reforms in a specific region (Bryant, 1969). According to Arabi and Abdalla (2013), the workers of developed countries are more productive as compared to developing countries because of their skills and capabilities. Health strategies can help change the lifestyle of poor citizens (Malenbaum, 1970). According to Cole and Neumayer (2005), individuals are badly affected by poor health and diseases. Even, quantifying the welfare loss of a person due to ill health is very difficult. Especially in developing countries where security and health care are limited. Unhealthy people do not provide a healthy lifestyle to their families and dependents. The burden of diseases adversely affects productivity and ultimately growth rate and then economic development. Due to fatal diseases, the quantity of labor supplies is lower.

In developing countries, the diseases which are extremely common namely malaria, waterborne diseases, and undernourishment affect workers. Siddique et al. (2020) examined that capital accumulation is necessary for the attainment of growth. To achieve growth, physical capital, as well as human capital, are considered the most influential. Health is a kind of human capital and is an important indicator to stimulate the process of development. According to Choudhry (2009), physical capital includes plant, equipment, and machinery used by a firm. Physical capital also includes transportation and infrastructure because they contribute to economic development. Umoru and Yaqub (1987) found that investment in health increases worker productivity. The Nigerian economy is very labor-intensive. For productivity maximization, healthy employees play a vital role. Health capital not only boosts the welfare of the people but also helps to raise productivity levels and enhance growth. When life expectancy reduces, it adversely affects the labor force. When the quantity of labor force decreases then productivity also falls and it adversely impacts Nigerian economic growth. Education plays a vital role for individuals and whole societies. At the primary level, 22 million children are far from the schools in South Asia. South Asia faces challenges in the health sector on a geographical as well as demographical scale. Pakistan, India, Bangladesh, Sri Lanka, and Nepal have approximately 1/5 population of the globe. South Asian countries are deprived of malnutrition, low life expectancy, infant mortality, TB, HIV, and AIDS. These countries also have health issues like poor sanitation, lack of healthcare services, poor maternal health, and malaria (Goode et al., 2014; Cole and Neumayer 2006; Ali, 2011). The objective of this study is to examine the impact of human health on worker productivity in South Asia from 1990 to 2019. This study is planned as Section 2 presents the overview of selective literature. A theoretical framework is presented in Section 3. A brief explanation of the variables and the data is presented in Section 4. The discussion and debate on the results are shown in Section 5. The conclusion and appropriate policy implications are suggested in Section 6.

II. LITERATURE REVIEW

In this section, the review of previous literature on the relationship between human health and worker productivity has been discussed. Siddique et al. (2018) explored that a positive relationship exists between life expectancy and economic growth, whereas negative relations exist between infant mortality and economic growth for 76 middle-income countries from 1991 to 2016. The results show that economic growth increases due to the contribution of education. The study also found that in upper-middle-income countries the impact of infant mortality, life expectancy, and education is stronger as compared to lower-middle-income countries. Biyase and Maleka (2019) also investigated that life expectancy has a positive impact on economic growth in 10 South African countries from 1985 to 2017. Ullah et al. (2019) investigated the impact of health on labor productivity in Pakistan for the period of 1980 to 2010. The findings show that improvement in health raises productivity. The results also show that education has been positively and significantly associated with worker productivity. Chaabouni et al. (2016) also investigated the two-way causality between health expenditures and economic growth for a panel of 51 countries for the period 1995-2013, using dynamic simultaneous equation models. Zortuk and Ceken (2015) also found that health care expenditure is most important in European Union from 1995 to 2011.

The study by Amiri and Linden (2016) show that the linkage between GDP per capita growth and change in child mortality rate has two-way relations for 175 countries from the period 1990 to 2014. The study of Shahbaz et al. (2019) reveals that in Sub-Saharan African countries, productivity and economic growth can be increased by improvement in health. The literature shows that life expectancy increases per capita income and economic growth (Mahumud et al., 2013; Ngangue and Manfred (2015). Lu et al. (2017) investigated the dynamic relationship between

environmental pollution, economic development, and public health in china. The study used panel data as well as cross-sectional data from 30 provinces of China from 2002 to 2014. Study shows that due to the fastest economic growth in China, the problem of environmental pollution has become a serious issue that causes deterioration of health. Arabi and Abdalla (2013) also examined the impact of human capital on economic growth in Sudan for the period 1982 to 2009 and found that quality education and health have a positive effect on growth. Goca (2014) investigated a long-run relationship between human capital and economic growth in Mozambique for the period 1975-to 2006.

Lenkei et al. (2018) investigated that investment in education plays a crucial role in economic development and growth in 14 Asian countries, including eight East Asian countries (Indonesia, Philippines, South Korea, Hong Kong, Malaysia, Taiwan, and Thailand & China) and five South Asian countries (Sri Lanka, Nepal, Bangladesh, India, and Pakistan) for the period of 1960-2013. The study by Bloom et al (2014) suggested that improvement in higher education boost economic growth in Africa from the period of 1975 to 2010. The results of Ogundari and Awokuse (2018) show that primary and secondary education has a significant effect on growth in 35 Sub-Saharan African countries from 1980 to 2008 by using dynamic panel data analysis. Awel 2013 recommended that investing in education boosts economic growth in the long term for Sweden from 1870 to 2000. This study also shows that bidirectional causality exists between education and output per worker.

III. THEORETICAL FRAMEWORK AND METHODOLOGY

The linkage between human health and worker productivity is not effortless. From the previous studies, the support related to the causal association between health and productivity has been attained. According to Schultz (1963) and Becker (1962), a correlation exists between wage and education, when the education level increases, the wage rate also increases. A healthy person actively performed their activities and enjoyed life very well as compared to an unhealthy person. A healthy person doesn't depend on others. Health function is exhibiting facts about the health condition of an economy. Following, Ali (2015), Ali (2018), Ali and Bibi (2017), Ali and Ahmad (2014), Ali and Audi (2016), Ali and Audi (2018), Ali and Rehman (2015), Ali and Senturk (2019), Ali and Zulfikar (2018), Ali et al., (2016), Ali et al., (2021), Ali et al., (2021), Ali et al., (2015), Arshad and Ali (2016), Ashraf and Ali (2018), Audi and Ali (2017), Audi and Ali (2017), Audi et al., (2021), Audi and Ali (2016), Audi et al., (2021), Audi et al., (2021), Audi et al., (2021), Haider and Ali (2015), Kaseem et al., (2019), Roussel et al., (2021), Senturk and Ali (2021), Audi et al., (2022), the model of this study become as;

$$Y = AL^\alpha K^\beta e^\mu \quad (1)$$

Here Y is total production, A represents knowledge, L is used for labor, and K is used for capital. The wages ω and individual productivity of one unit of labor is,

$$\omega = \frac{\Delta Y}{\Delta L} = A\alpha L^{\alpha-1} K^\beta e^\mu \quad (2)$$

$$\omega = \alpha AL^\alpha L^{-1} K^\beta e^\mu \quad (3)$$

$$\omega = \alpha \frac{AL^\alpha K^\beta e^\mu}{L} \quad (4)$$

$$\omega = \frac{\Delta Y}{\Delta L} = \alpha \frac{Y}{L} \quad (5)$$

By applying logarithm on Eq.1, we get,

$$\log Y = \log A + \alpha \log L + \beta \log K + \mu \quad (6)$$

$$\log Y = \alpha_0 + \alpha \log L + \beta \log K + \mu \quad (7)$$

Several approaches are employed for developing productivity across the countries over time, but we are following the approach used by Bloom et al. (2001). Labor productivity (LP) varies from country to country in the long run.

$$\Delta(LP) = \delta[LP^* - LP] + \ddot{u} \quad (8)$$

Where \ddot{u} is a random term, δ is the productivity rate towards an optimum and actual level of productivity. Every economy has an optimum level of productivity (LP^*), and an actual level of productivity (LP).

It is considered that the increasing level of productivity for a county is influenced by global expertise and an economy's characteristics. This can be shown in this way,

$$LP^* = LP + \phi Z \quad (9)$$

$$LP^* - LP = \phi Z \quad (9a)$$

$$\ddot{w} = \phi Z \quad (10)$$

$$\log \ddot{w} = \log(\phi Z) \quad (11)$$

$$\log \ddot{w} = \log \phi + \log Z \quad (11a)$$

where, Z indicates the specific factors of a country that change productivity, LP demonstrates the current productivity worldwide. The Z variable includes three indicators income (Y), human health (HH), and education (ED) which can be expressed as;

$$Z = f(Y, HH, ED) \quad (12)$$

It can be shown in Cobb Douglas form by considering Z as the output

$$Z = Y^{\varphi_1} HH^{\varphi_2} ED^{\varphi_3} \quad (13)$$

By substituting equation (13) into equation (11a), it formulates as;

$$\log \dot{w} = \log \phi + \log (Y^{\varphi_1} PH^{\varphi_2} ED^{\varphi_3}) \quad (14)$$

$$\log \dot{w} = \log \phi + \varphi_1 \log Y + \varphi_2 \log HH + \varphi_3 \log ED \quad (15)$$

By replacing equation (7) with equation (15), we obtain

$$\log \dot{w} = \log \phi + \varphi_1 (\alpha_0 + \alpha \log L + \beta \log K + \mu) + \varphi_2 \log HH + \varphi_3 \log ED \quad (16)$$

$$\log \dot{w} = \log \phi + \varphi_1 \alpha_0 + \varphi_1 \alpha \log L + \varphi_1 \beta \log K + \varphi_1 \mu + \varphi_2 \log HH + \varphi_3 \log ED \quad (17)$$

$$\log \dot{w} = \log \phi + \varphi_1 \alpha_0 + \varphi_1 \alpha \log L + \varphi_1 \beta \log K + \varphi_2 \log HH + \varphi_3 \log ED + \varphi_1 \mu \quad (17a)$$

$$pro_{it} = \theta_0 + \theta_1 l_{it} + \theta_2 k_{it} + \theta_3 hh_{it} + \theta_4 ed_{it} + \varepsilon_{it} \quad (18)$$

Equation. 18 is obtained from the aggregate production model and this equation is considered an empirical model for the analysis of panel data where,

$$pro_{it} = \log \dot{w}, \theta_0 = \log \phi + \varphi_1 \alpha_0, \theta_1 l_{it} = \varphi_1 \alpha \log L, \theta_2 k_{it} = \varphi_1 \beta \log K, \theta_3 ph_{it} = \varphi_2 \log PH, \text{ and } \theta_4 ed_{it} = \varphi_3 \log ED, \text{ and } \varepsilon_{it} = \varphi_1 \mu.$$

Productivity is used as a dependent variable and health is used as an independent variable. The study uses a proxy variable for health that is utilized in literature i.e. life expectancy (Cole and Neumayer, 2006; Siddique et al., 2020). For education, secondary school enrollment is used which is also used in literature (Shahid et al., 2019). The term i is used for countries and t is used for the time 1991-2019. The expression pro is worker productivity, l term is used for labor, k is used for capital, le is for life expectancy and ed indicates education. The term θ_0 is intercept, $\theta_1, \theta_2, \theta_3$ and θ_4 are the elasticity of explanatory variables concerning productivity. This study used panel OLS, fixed-effects model, random-effects model, and Generalized method of moments (GMM).

IV. DATA

Various variables are engaged to demonstrate the linkage between health and productivity in South Asia, data has been used from 1991 to 2019. South Asian countries are Pakistan, Bangladesh, Nepal, India, Sri Lanka, Maldives, Afghanistan, and Bhutan. World development indicators (WDI) is the source of data for all variables (Table 1). The dependent variable is worker productivity and several independent variables have been taken. The health proxies that are used in this study are life expectancy (LE at birth indicates how many years a newborn would live). Gross capital formation is the symbol of economic growth which is also used in this study. The indicator of education is school enrollment at the secondary level. Labor force (population participating in labor having ages 15+ years are included in the labor force). Life expectancy means the average age of persons of a specific population at the time of death. It refers to the expected age of a person. Life expectancy decreases due to poor health and diseases. It can be improved by other factors like rising living standards, improvement in education, improvement in lifestyle, and access to health facilities. Shahbaz et al. (2019) showed that in Sub-Saharan African countries, productivity and economic growth can be increased by improvement in health.

Table 1: Definition of the variables and Source

Variables	Summary of Variables
Worker productivity (PRO)	GDP per person employed is a measurement of output per employee or worker (Purchasing power parity in dollars on constant, 2017)
Life Expectancy (LE)	The total number of years that a person would live at the time of birth till all over its existence or life.
Gross capital formation (K)	Gross capital formation means total domestic investment, (constant 2010 US dollar)
Labor force (L)	Labor force participation rate means the population having 15+ ages actively participating in the production process, total (percentage or proportion of total population 15+ age group)
School Enrollment, Secondary (SEC)	Secondary School Enrollment, (percentage of population)

Source: WDI, 2020

Table 2 shows the descriptive statistics of the data. The maximum worker productivity (PRO) is 33296.24 and the minimum is 3001.608 which is measured as income per person. The maximum life expectancy is 76.8120 years and the minimum LE is 54.4040 years in South Asian Countries. The details of other variables are mentioned in Table 2.

Table 2: Descriptive Statistics

Variables	Obs.	Mean	Std. Dev.	Min	Max
PRO	141	10943.54	6823.142	3001.608	33296.24
L	145	60.4823	11.7758	49.2200	86.26500
K	134	1.14E+11	2.25E+11	2155897958.84	991394766124.85
LE	141	66.2431	5.1367	54.4040	76.8120
POU	87	14.6701	3.9634	6.4000	23.6000
SE	103	54.4884	19.5503	20.9083	100.3352

Table 3 demonstrates the direction of the relationship that exists among variables. Life expectancy (LE), capital, and education are positively associated with PRO. The negative symbol of labor points out that labor (L) has a negative correlation with worker productivity.

Table 3: Correlation Results

Variables	PRO	L	K	LE	SE
PRO	1.0000				
L	-0.5201	1.0000			
K	0.1823	-0.3147	1.0000		
LE	0.6561	-0.0592	-0.0526	1.0000	
SE	0.6145	-0.0173	0.2113	0.8099	1.0000

V. RESULTS AND DISCUSSION

This Section contains the empirical results of the study. Table 4 shows the results of panel OLS, fixed-effects model, random-effects model, and generalized method of moments (GMM). The prime objective of our study is to examine the influence of human health on worker productivity. Ullah et al. (2019) showed that health improvement would raise productivity and the education coefficient has been positively and significantly associated with worker productivity. Results of panel OLS show that life expectancy has a positive correlation with worker productivity. The coefficient of LE is 2.55 which indicates that a 1% change in LE causes a 2.55% variation in worker productivity. The study also reveals that education has a positive effect on worker productivity, the coefficient shows a 1% rise in education brings a 0.0076% change in worker productivity. The coefficient of labor (-2.4326) shows a negative impact on productivity. Productivity is measured by GDP per employee over labor, so the increasing trend of labor has an inverse impact on productivity. The results are consistent with the literature (Siddique et al., 2020).

Results of the fixed effects approach also show that life expectancy is an increasing factor in productivity, the coefficient of LE is 2.9243 which indicates that a 1% change in LE causes a 2.92% variation in worker productivity. The study also reveals secondary education brings a 0.0544% change in worker productivity. The coefficient of labor is -0.6693 which shows a negative correlation with productivity. The coefficient of capital is 0.4632 which expresses the positive and significant correlation with productivity. According to the results of the random effects approach, the life expectancy coefficient is 4.1146 which indicates that a 1% change in LE causes a 4.1146% variation in productivity. The study also reveals that secondary education brings a 0.1253% change in productivity. The coefficient of labor is -2.3286 which shows a negative but significant correlation with productivity. Results of GMM show that health, education, and capital are the increasing factors of worker productivity, while the coefficient of labor (-0.1777) shows a negative but significant correlation with productivity. The findings are consistent with the studies of Biyase and Maleka (2019), Lenkei et al. (2018), and Siddique et al. (2020).

VI. CONCLUSION

This is approved that there exists a strong association between economic development and health. Health improvement directly influences productivity and then economic growth rises. However, this study investigates the association between health and productivity in South Asian countries from 1991-to 2019. Health not only uplifts life expectancy but also boosts productivity. Skilled workers contribute more to economic growth compared to uneducated and unskilled people. A healthy life raises prosperity and improves the standard of living of the citizens of

the country. Investment in the health sector should be increased by the federal as well as the provincial government. For the better functioning of the health system, the government should increase its share of financing in the health sector.

Table 4: Results

Variables	Dependent Variable: Productivity							
	Panel OLS		FE Model		RE Model		GMM Model	
	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
PRO(-1)							0.8465	0.0000
L	-2.4326	0.0000	-0.6693	0.0000	-2.3286	0.0000	-0.1777	0.0053
K	-0.0127	0.5484	0.4632	0.0000	0.0039	0.5907	0.0476	0.0048
LE	2.5537	0.0027	2.9243	0.0009	4.1146	0.0000	0.9988	0.0380
SE	0.0076	0.0022	0.0544	0.6278	0.1253	0.0049	0.0026	0.8979
C	8.1932	0.0460	-2.6683	0.3034	0.7281	0.5616	0.2614	0.3496
R-square	0.8123		0.7922		0.7917		0.8199	
Obs.	89		89		89		80	

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