How Does Human Capital Affect Economic Growth in India? An Empirical Analysis

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Abstract

The study attempts to examine the relationship between human capital and economic growth in India. The study utilizes annual time series data for the period 1980 to 2017. Real Gross Domestic Product is used as a proxy for economic prosperity and the Human Capital Index is taken as a proxy for the level of human capital. Conventional sources of growth are controlled by physical capital, trade openness and inflation. Johansen Cointegration and Fully Modified Ordinary Least Square (FMOLS) techniques are applied to look into a long-run equilibrium relationship. Toda and Yamamoto (1995) Granger's causality test is used as a short-run diagnostic test for the long-run equilibrium relationship. The major findings of the study suggest human and physical capital is the major determinant of economic development in the long-run, whereas in the short-run the level of economic prosperity determines the level of human and physical capital, the volume of trade and fiscal space of the government.

Key Words: Human Capital, Economic Growth, India, FMOLS

JEL Classification: O380, O400, O110, E010

1. Introduction

The concept of 'human capital' was first introduced and formulated by Becker (1962) and Rosen (1976). Human capital is defined as the resources, skills, knowledge and qualifications that are available and acquired by individuals to maximize their employability. A healthy,

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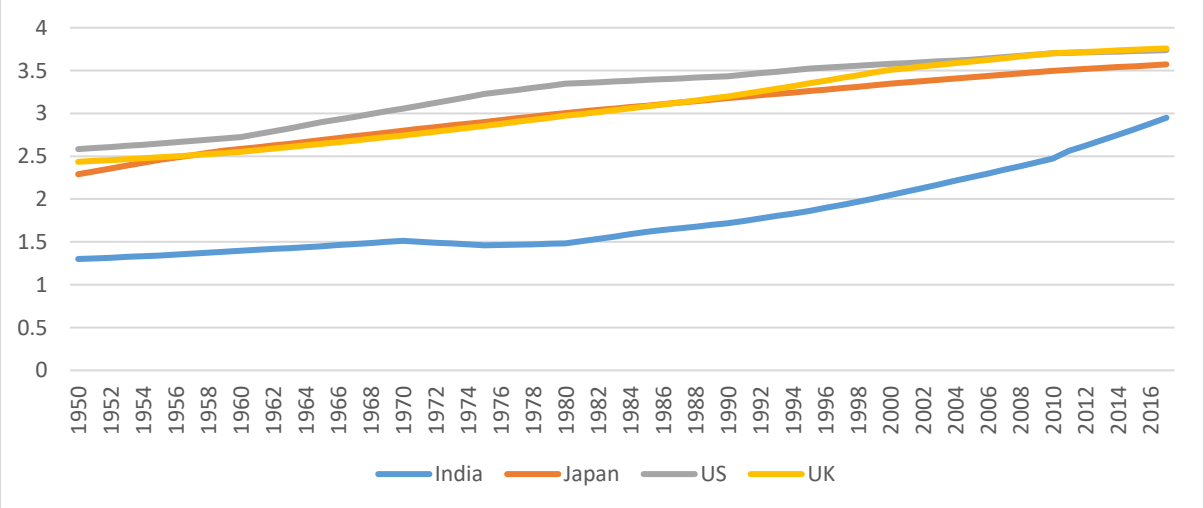
educated and productive labour results in long-term economic prosperity. Thus, a country should focus on health and education for better economic outcomes in the long-run.

India is one of the fastest-growing economies of the world. The high growth led by total factor productivity is not sustainable because human capital and governance are the major determinants of economic development in the long-run (Singh, 2019, 2020).

In the 1990s, a large number of studies were conducted to examine the role of human capital and other determinants of economic growth (Barro, 1991; Mankiw et al. 1992). Neo-classical and endogenous growth theories found various determinants of growth such as human capital, foreign trade, government consumption and institutions. The most significant determinant of economic growth used in the majority of studies was the level of human capital stocks (Barro, 1991; Hanushek and Wößmann, 2012; Aisen and Veiga, 2013).

Figur1 shows status of human capital in India, Japan, United States of America (USA) and United Kingdom (UK). The empirical evidence show most of the advanced economies are also having higher levels of human capital as compare to India.

Figure 1. Status of Human Capital in India, Japan, USA and UK



Source: Pen World Table 9.1[§]

[§] For methodology read Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015), "The Next Generation of the Penn World Table" American Economic Review, 105(10), 3150-3182.

There is a positive growth in the level of human capital in India as compare to independence but the success in the attainment of human capital is not satisfactory (Figure 1). According to the United Nations Development Programme (UNDP) 2019 report, India ranks at 129th position out of 189 countries.

In view of the above, the current study attempts to examine the impact of human capital and other determinants of economic growth in India. The study examines long-run and short-run determinants of growth for the period 1980 to 2017. The major findings of the study suggest human and physical capital is the major determinant of economic development in the long-run, whereas in the short-run the level of economic prosperity determines the level of human and physical capital, the volume of trade and fiscal space of the government.

The remainder of the paper is organised as follows: The review of the literature is reported in section 2. The analytical framework of the study is covered in section 3. Data and methodology adopted in the current study are reported in Section 4. The empirical results are discussed in section 5. The study concludes with a section 6.

2. Survey of Literature

There is a large number of theoretical and empirical studies on human capital which confirms good health and better education quality affects the economic growth and prosperity of a country.

The endogenous growth models emphasize human as a major determinant of long-run economic development (Romer, 1989; Lucas, 1988). Caselli et al. (2006) in a panel study found labour productivity is influenced by the investment in the human capital.

Bloom et al. (1998) conducted a study on developing countries and found health and demography are the major determinants of economic development. Mayer-Foulkes et al (2008)

on a study on Mexican state concluded life expectancy significantly affects the economic prosperity of the country.

Arora et al. (2000) examined the association of health indicators on economic prosperity. The study reveals health indicators have a significant impact on economic outcomes. Arora (2001) again conducted a study and concluded with similar results. Stark and Wang (2002) in a cross-country study on developing countries found education can be used as a major tool of poverty alleviation and economic prosperity.

Haldar (2008) in a state-level study concluded health and education are the major determinants of long-run economic growth. Similarly, Haldar and Mallik (2010) conducted a study on the Indian market to examine the impact of the different determinant of growth such as physical capital stock, human capital stock and the volume of trade on economic development in three different growth equations. The major findings of the study suggest human capital is the most significant determinant of growth in the Indian market.

Siddiqui and Rehman (2017) examined human capital-growth nexus in 10 Asian countries. The major finding of the study suggests countries differ in economic prosperity also differ in the level of educational attainment.

Sehrawat and Singh (2019) examined the impact of human capital as the determinant of income inequalities across the Indian states. The study reveals human capital is positively associated with the income inequalities of the states.

On the other side, Benhabib and Spiegel (1994) and Pritchett (1997) found a weak association between economic growth and the level of educational attainments in cross-country studies.

In light of the above, the current study attempts to examine the association of human capital with economic prosperity and other determinants of economic development in the long and short-run in India.

3. Analytical Framework

The association between human capital and economic growth can be measured by a standard production model:

$$Y = f(K, L) \tag{1}$$

where Y, L and K are measures of output, capital and labour respectively. The above relationship in Eq. (1) can be modified using Barro–Lee–Mankiw (Barrow, 1991; Barro and Lee 2000; Mankiw et al. 1992) specification which is also adopted by Siddiqui and Rehman (2017). These growth models utilize the factors of production as its explanatory variables in a multi variate regression (Sala-i-Martin, Doppelhofer, and Miller, 2004).

$$Y_t = \beta_0 + \beta_1 PC_t + \beta_2 HC_t + U_t \tag{2}$$

In Eq. (2), the dependent variable Y_t is the level of output or real GDP and the independent variables are physical capital PC_t at time t and human capital HC_t at time t. The growth Eq. (2) can be modified by adding some control variables:

$$Y_t = (PC, HC, Control) \tag{3}$$

Eq. (3) further can be specified with and without dummy variables for economic reforms started since 1991. The growth Eq. (3) without incorporating economic reforms can be written as:

$$Y_t = \beta_0 + \beta_1 PC_t + \beta_2 HC_t + \beta_3 TO_t + \beta_4 INF_t + U_t \tag{4}$$

On the other side, growth equation after incorporating economic reforms can be written as:

$$Y_t = \beta_0 + \beta_1 PC_t + \beta_2 HC_t + \beta_3 TO_t + \beta_4 INF_t + \beta_5 D1_t + U_t \tag{5}$$

In Eq. (4) and (5) TO_t is a trade to GDP ratio used as a proxy for the openness of the economy. INF_t is inflation used as a measure of the price level in the economy and D1 is a dummy

variable used to take care of economic reconstruction started since 1991. Dummy takes value 1 for reconstruction 1991 onwards, otherwise 0 for the control period.

4. Data and Methodology

4.1 Data

The study utilizes annual time series data for the period 1980 to 2017. Real GDP is taken as a proxy of economic performance, Human Capital Index is taken as a proxy for human capital (HC), gross fixed capital formation is taken as a proxy for physical capital (PC), total trade as a share of GDP is taken as a proxy of trade openness (TO) and GDP deflator is used as a proxy of inflation (INF). The real GDP, trade openness and GDP deflator data are taken from the World Bank. Human Capital Index (HCI) data is taken from Pen World Table 9.1.

In the current case, natural log of all the variables are taken.The descriptive statistics of the variables used in the study are reported in Table 1. The mean value of LnPERGDP, LnPC, LnHC, LnTO and LnINF are 15.227, 13.818, 1.702 and 59.423 respectively. The skewness statistics is close to 0 for all the variable implying normality. Kurtosis statistics is less than 3 for all the variables implying lighter tail in the data set.

Table 1: Descriptive Statistics

Variables	LnGDP	LnPC	LnHC	LnTO	LnINF
Mean	15.227	13.818	1.702	29.329	59.423
Median	15.200	13.736	1.734	24.258	51.078
Maximum	16.394	15.235	2.124	55.794	159.830
Minimum	14.197	12.597	1.285	12.219	9.737
Std. Dev.	0.658	0.852	0.261	14.779	44.823
Skewness	0.141	0.176	-0.048	0.468	0.885
Kurtosis	1.811	1.670	1.687	1.730	2.683
Jarque-Bera	2.364	2.996	2.744	3.937	5.124
Probability	0.307	0.224	0.254	0.140	0.077
Sum	578.622	525.067	64.673	1114.509	2258.062
Sum Sq. Dev.	16.029	26.876	2.515	8081.719	74335.350
Observations	38	38	38	38	38

Source: Author's estimation

Table 2 reports the correlation matrix of the considered variables. From Table 2, there is a positive significant linear association of LnGDP with LnPC, LnHC, LnTO and LnINF which is consistent with the past empirical literature on endogenous growth theory and the determinant of economic growth. The descriptive statistics gives enough evidence to examine the long-run and short-run association between the considered variables.

Table 2: Correlation Matrix

Variables	LnGDP	LnPC	LnHC	LnTO	LnINF
LnGDP	1				
p-value	-----				
LnPC	0.997	1			
p-value	0.000	-----			
LnHC	0.995	0.991	1		
p-value	0.000	0.000	-----		
LnTO	0.919	0.940	0.912	1	
p-value	0.000	0.000	0.000	-----	
LnINF	0.961	0.956	0.940	0.858	1
p-value	0.000	0.000	0.000	0.000	-----

Source: Author's estimation

4.2 Methodology

In the context of time series data analysis, the first step is to test the stationarity of the variables. The presence of unit root in the considered variables are tested by Augmented Dickey-Fuller (ADF) and Phillips-Perron tests (Dickey and Fuller, 1981; Phillips and Perron, 1988).

After examining the stationarity of the considered variables Johansen procedure of cointegration is applied to look into a long-run equilibrium relationship (Johansen, 1988; 1990). The long-run dynamics is examined using Fully-Modified Ordinary Least Square (Pedroni, 1996).Finally, Toda and Yamamoto (1995) Granger causality is applied to look into the short-run dynamics of the long-run equilibrium relationship.

5. Empirical Results

5.1 Long-run

The first step in examining the long-run equilibrium relationship among the considered variables to check the presence of unit root and level of integration of the considered

variables. For this, unit root tests such as Augmented Dickey-Fuller (ADF) and Phillips-Perron is conducted for the considered variables. The results of unit root tests are reported in Table 3. The results of the ADF and PP test shows all the variables are non-stationary at the level. Therefore, the null hypothesis of non-stationarity cannot be rejected because all the series contains a unit root. At first, difference, using both the tests, the null hypothesis of non-stationarity can be rejected because all the series at the first difference is integrated of order I (1) at the 1 and 5 per cent level of significance. Now, the Johansen procedure of cointegration can be employed to look into the long-run equilibrium relationship.

Table 3. Unit Root Results

Variables	LnGDP	LnPC	LnHC	LnTO	LnINF
ADF					
Level	-1.202	-2.627	-3.141	-2.130	1.669
P-value	0.895	0.271	0.113	0.510	1.000
1st Difference	-6.273	-7.707	-1.749	-2.441	-3.924
P-value	0.000	0.000	0.065	0.352	0.024
PP-Fisher Chi-square					
Level	-0.516	-2.590	-1.9241	-1.798	0.203
P-value	0.978	0.287	0.622	0.685	0.997
1st Difference	-15.007	-7.704	-2.256	-5.110	-2.320
P-value	0.000	0.000	0.046	0.001	0.043

Source: Author's estimation

The long run-equilibrium relationship of the variables mentioned in Eq. (4) is examined using the Johansen cointegration test. The result of the cointegration test is reported in Table 4. Lambda (λ) trace and max tests are conducted to find a maximum number of cointegrating vectors. To start with λ trace test, the trace value at null hypothesis r = 0 is 92.775, which is higher than the critical value at 5 per cent level of significance. Therefore, it rejects the null of no cointegrating vectors and accepts alternative of cointegrating vector greater than 1 (r>1). Similarly, the test is repeated for hull r≤2, where the trace value is 56.398 which is again greater than the critical value at 5 per cent level of significance. Hence, again we reject the null hypothesis. For null r≤2, we accept the null hypothesis because λ trace value is lower than the

critical value at 5 per cent level of significance. Therefore, the existence of 2 cointegrating vectors is concluded from λ trace test.

Table 4: Johansen Co-integration Test									
Hypothesis		λ Trace Value	Critical Value		Hypothesis		λ Max Value	Critical Value	
H0	H1		0.005	p-value	H0	H1		0.005	p-value
r=0	r>1	92.775	69.819	0.000	r=0	r=1	69.819	69.819	0.000
r≤1	r>2	56.398	47.856	0.006	r=1	r=2	47.856	47.856	0.006
r≤2	r>3	27.940	29.797	0.081	r=2	r=3	29.797	29.797	0.081
r≤3	r>4	9.701	15.495	0.305	r=3	r=4	15.495	15.495	0.305
r≤4	r>4	0.020	3.841	0.888	r=4	r=5	3.841	3.841	0.888

Source: Author's estimation

From the λ max test, the null of r=0 and r=1 is rejected because λ max in both the situation is equal to the critical value at 5 per cent level of significance. Hence, from λ trace and λ max tests, it can be concluded that in the long-run two cointegrating vectors exist between the considered variables.

After confirming long-run equilibrium among the considered variables, long-run dynamics is checked and long-run coefficients are obtained using FMOLS technique. Table 5 reports FMOLS results of the model (1) and (2) of Eq. (4) and (5) respectively. In model 1, the effect of economic reconstruction is excluded whereas, in model 2, it is included.

Table 5. FMOLS Results				
Variables	Model 1		Model 2	
	Coefficients	p-value	Coefficients	p-value
LnPC	0.498	0.000	0.568	0.000
LnHC	0.814	0.001	0.481	0.083
LnTO	-0.003	0.090	-0.003	0.043
LnINF	0.001	0.018	0.002	0.003
D1			0.053	0.064
C	6.955	0.000	6.510	0.000
R Square	0.998		0.999	
Ad R Square	0.998		0.998	

Source: Author's estimation

In both the model, human capital (LnHC) is positively associated with economic output and statistically significant at 1 and 8 per cent level of significance respectively. Physical capital stock (LnPC) is also positively associated with economic output in both the models and found to be statistically significant at 1 per cent level of significance. The trade openness (LnTO) is negatively associated with the level of output in both the models (Model 1 and 2) and statically

significant at 9 and 4 per cent level of significance respectively. Inflation (INF) is also positively associated with the level of output in both the models and also found to be statistically significant at 1 per cent level of significance. The dummy variable (D1) included for economic reconstruction is found to be positively associated with economic output and statistically significant at 6 per cent level of significance.

In general, the sign of the variables in both the models are same except for the trade openness (TO). All the other variables are positively associated with the economic output. The rise in physical capital stock helps the country to expand its productive capacity. In the case of India, the empirical results show there is a significant impact of the rise in capital stock on the production in the economy. From neoclassical endogenous growth theories, human capital is the major determinants of economic development in the long-run. In the Indian case, the FMOLS long-run estimates confirm the validity of the human capital theory. The impact of trade openness is found to be negative in the case of India because of negative net international trade. Similarly, the validity of the Phillips curve is also tested in the case of India. The positive coefficients of inflation in both models confirm the validity of the Phillips curve in the Indian case.

Finally, there is a positive impact of economic reconstruction started since 1991. The magnitude of elasticities estimated in model 1 and 2 shows the role of physical and human capital is important for economic development in the long-run. The elasticities of trade openness, inflation and economic reconstruction are very small which shows India is benefited from liberalization which also helped integration of the Indian market with the rest of the world. This led to an increase in trade volume and through total factor productivity helped the Indian economy to fully utilize the domestic factors of production. The smaller negative value of trade openness is because of negative trade balance and high imports. Therefore, from empirical

long-run estimates, it can be concluded in the long-run human capital is the major determinant of economic output along with the physical capital stock.

5.2 Short-run

The short-run diagnostic test of the long-run equilibrium relationship conducted using Toda and Yamamoto (1995) Granger causality test. The result of short-run diagnostics test is reported in Table 6. The short-run diagnostic test shows there is no significant impact of physical capital, human capital, trade openness and inflation on the economic output in the short-run. On the other side, higher economic output helps to achieve higher physical and human capital, larger trade volume and larger fiscal space for the government.

Table 6: Toda–Yamamoto Granger causality test

Variables	Observation	Chi-Square	p-value
Physical Capital does not Granger Cause GDP	36	1.503	0.238
GDP does not Granger Cause Physical Capital		2.757	0.079
Human Capital does not Granger Cause GDP	36	0.291	0.749
GDP does not Granger Cause Human Capital		3.237	0.053
Trade Openness does not Granger Cause GDP	36	0.040	0.961
GDP does not Granger Cause Trade Openness		3.706	0.036
Inflation does not Granger Cause GDP	36	0.021	0.979
GDP does not Granger Cause Inflation		4.763	0.016

Source: Author's estimation

6. Conclusion and Policy Options

The role of human capital in the determination of economic output is examined in the current study in the Indian market. The annual times series data for the period 1980 to 2017 is used to examine the relationship. The long-run equilibrium relationship and dynamics are examined using FMOLS techniques. Toda and Yamamoto (1995) Granger causality test are employed as a short-run diagnostic test for the long-run equilibrium relationship.

The major finding of the study shows there is a positive and significant impact of human and physical capital on economic output in the long-run. On the other side, in the short-run, the level of economic output determines the level of human and physical capital, trade volume and fiscal space for the government.

Hence, in the short-run reforms are warranted in the Indian market to make it more efficient for the positive and significant impact of the major determinant of growth such as human and physical capital in the long-run.

References:

Aisen, A., & Veiga, F.J. (2013). How does political instability affect economic growth. Eur. J. Political Econ, 29, 151–167.

Arora, A., Florida, R., Gates, G. J., & Kamlet, M. (2000). Human capital, quality of place, and location. Pittsburgh, PA: Carnagie Mellon University.

Arora, S. (2001). Health, human productivity, and long-term economic growth. The Journal of Economic History, 61(3), 699-749.

Becker, G., 1962. Investment in human capital: a theoretical analysis. J. Political Econ. 70, 9–49 (5, part 2)

Barro, R. J. (1991). Economic Growth in A Cross Section of Countries. The Quarterly Journal of Economics, 106, 407– 443.

Barro, R. J., & Lee, J. W. (2000). International Data on Educational Attainment: Updates and Implications. Center for international development at Harvard University: CID Working paper 42. Cambridge, MA.

Benhabib, J., & Spiegel, M. M. (1994). The role of human capital in economic development evidence from aggregate cross-country data. Journal of Monetary economics, 34(2), 143-173.

Bloom, D. E., Sachs, J. D., Collier, P., & Udry, C. (1998). Geography, demography, and economic growth in Africa. Brookings papers on economic activity, 02, 207-295.

Caselli, F., Coleman, I. I., & John, W. (2006). The world technology frontier. American Economic Review, 96(3), 499-522.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. Journal of the American statistical association, 74(366a), 427-431.

Hanushek, E.A., & Wößmann, L. (2012). Schooling, educational achievement, and the Latin American growth puzzle. J. Dev. Econ., 99 (2), 497–512.

Haldar, S. K., & Mallik, G. (2010). Does human capital cause economic growth? A case study of India. International Journal of Economic Sciences & Applied Research, 3(1).

Haldar, S. (2008). Effect of Health Human Capital Expenditure on Economic Growth in India: A State Level Study. Asia-Pacific Social Science Review, 8(2).

Hanushek, E.A. & Wößmann, L. (2012). Schooling, educational achievement, and the Latin American growth puzzle. J. Dev. Econ., 99 (2), 497–512

Johansen, S. (1988). Statistical analysis of cointegration vectors. Journal of economic dynamics and control, 12(2-3), 231-254.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. Oxford Bulletin of Economics and statistics, 52(2), 169-210.

Lucas, R. (1988). On the mechanics of economic development. Journal of monetary economics.

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

Mayer-Foulkes, D. (2008). The human development trap in Mexico. World development, 36(5), 775-796.

Pritchett, L. (1997). Divergence, big time. Journal of Economic perspectives, 11(3), 3-17.

Pedroni, P. (1996). Fully modified OLS for heterogeneous cointegrated panels and the case of purchasing power parity. Manuscript, Department of Economics, Indiana University, 5, 1-45.

Rosen, S. (1976). A theory of life earnings. Journal of Political Economy, 84(4, Part 2), S45-S67.

Romer, P. M. (1989). Human capital and growth: theory and evidence (No. w3173). National Bureau of Economic Research.

Sehrawat, M., & Singh, S. K. (2019). Human capital and income inequality in India: is there a non-linear and asymmetric relationship? Applied Economics, 51(39), 4325-4336.

Robert C., Robert Inklaar, & Timmer, M. P. (2015). The Next Generation of the Penn World Table" American Economic Review, 105(10), 3150-3182.

Sala-i-Martin, X., G. Doppelhofer, & Miller, R. (2004). Determinants of Long-Term Growth: A Bayesian Averaging of Classical Estimates (BACE) Approach, American Economic Review, 94 (4), 813–835.

Stark, O., & Wang, Y. (2002). Inducing human capital formation: migration as a substitute for subsidies. Journal of Public Economics, 86(1), 29-46.

Siddiqui, A., & Rehman, Atiq ur (2017). The human capital and economic growth nexus: in East and South Asia, Applied Economics, 49(28), 2697-2710.

Singh, B. P. (2019). Does Governance Matter? Evidence from BRICS. Global Business Review, 0972150919861222.

Singh, B.P. & Pradhan, K.C. (2020). Institutional Quality and Economic Performance in South Asia. Public Affairs. (Forthcoming)

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. Journal of econometrics, 66(1-2), 225-250.

UNDP (2019) Human Development Report. http://hdr.undp.org/en/content/2019-human-development-index-ranking