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IMPACT OF HUMAN CAPITAL ON ECONOMIC GROWTH IN ASIAN COUNTRIES

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ABSTRACT

Human capital is a critical factor of economic growth and economic development. In the last few decades, scholars, economists, and policymakers have paid close attention to the significance of human capital as they have attempted to understand the complex relationship between a country's economic growth, and quantity and quality of its labor force. This study aims to investigate the impact of human capital on the economic growth of 48 Asian countries taking annual data of sample period from 2014 to 2023. This study considers proxies of economic growth as real GDP and the proxies of human capital as government spending on education and health, life expectancy at birth and secondary school enrollment. The estimation techniques comprise of distribution statistics, panel unit root test, correlation matrix, diagnostic test, Hausman test, and regression. From the Hausman test, the study found fixed effect model as the best model to describe relationship between human capital and economic growth. Due to the problem of heteroskedasticity, a robust fixed effect model was employed. The results found that gross fixed capital formation, government expenditure on health, life expectancy at birth, secondary school enrollment have positively and significantly influence economic growth, whereas government expenditure on education and population growth have negatively and significantly influence economic growth in Asian countries. Most of these countries are facing several economic, political, and social issues and among all they are facing a vicious circle of poverty. The rapid rise of the population may put strain on limited resources, while deficiencies in the distribution of funds for education could hinder economic advancement. Therefore, authorities should consider implementing population management measures and optimizing education expenditures to align with economic goals. Overall, the study provides a

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comprehensive and inclusive framework of the impact of human capital on the economic growth in Asian countries.

Keywords: Economic Growth, FEM, Government Expenditure on Health, Government Expenditure on Education

JEL Codes: C33, E24, H51, H52

1. INTRODUCTION

Human capital, which includes the knowledge, skills and capacities of a country's workforce, is a critical factor of economic growth and development. In the last few decades, scholars, economists, and policymakers have paid close attention to the significance of human capital as they have attempted to understand the complex relationship between a country's economic growth and the quality of its labor force. This understanding was initiated by the work of Schultz (1961) and later Uzawa (1965), Nelson and Phelps (1966), and Rosen (1976) argued that new and advanced technology can only be adopted and implement if human capital stock is improved. According to human capital theory, by investing in healthcare, education, and training, people can be more productive, and communities become more economically secure and increase workers' efficiency at workplace (Schultz, 1961). Furthermore, Becker (1962) added the importance of human capital by stating the knowledge, skills, abilities, and characteristics of people foster economic value and their productivity in the economy that need better education and health care.

It is believed that health and economic growth are two faces of a coin. With the improvement in the health indicators, a country experiences economic growth and development (Ozyilmaz et. al., 2022). An improvement in life expectancy at birth represents better health conditions for the people and the country. In the same manner, an increase in government expenditure on health enhances labor productivity, which ultimately fosters economic growth (He & Li, 2020). Ifa and Guetat (2019), and Wahab et al. (2018) argued that the health care supported by human capital investments has a crucial role in economic growth. Therefore, this study aims to examine the impact of government expenditure on health and life expectancy at birth on economic growth in Asian countries.

Furthermore, education plays a crucial role in bringing social changes and increasing productivity in the workplace, which adds positive economic externalities. Educational development is correlated with significant investment in this field, facilitating efficient resource use (Adelakun, 2011). People with higher levels of education are better able to create

development policies and can boost growth and productivity. A high level of human capital attained through many ways, such as worker knowledge, technical innovation and its application, and knowledge transmission and diffusion, is associated with education (Garza-Rodriguez et al., 2020a). That certainly contributes to higher labor productivity. Pelinescu (2015) argued that human capital has a direct impact on economic growth since it produces productivity. The economy grows faster as human minds produce productivity through invention and technical development for which spending on education is deem necessary (Osiobe, 2019). In line with it, Ozturk (2001) expounded on the significance of human capital in the nation's development, examining its various dimensions encompassing the individual, family, community, politics, economics, and innovation. However, this is made feasible by human skill development and education, which requires financial support, particularly for school enrollment and instruction. The development of the economy can only be guided by human capital; that is education, training, and research and development. Thus, this study aims to investigate the impact of government expenditure on education and school enrollment on the economic growth of Asian countries.

According to the United Nations Conference on Trade and Development (2023), the forty least developed countries need more human capital. They are susceptible to shocks in the economy and environment. It was found that low human capital development and low per capita income levels are found in the least developed countries. Every nation in the world aims to improve its citizens' living standards. The country's ability to sustain its economic growth at a high rate depends on its citizens' living standards and general quality of life (Cypher & Dietz, 2009). From the empirical studies it is found that government spending on both health and education supports human capital formation which promotes economic growth (Schultz, 1961; Devarajan, 1996; Lee & Barro, 1997; Ifa & Guetat, 2019; Ozyilmaz et. al., 2022). From the prior knowledge, it is less likely to be found that such efficacy of government spending on both health and education in Asian countries. The studies of Hanif and Arshad (2016), Kiran (2014), Gajurel and Dangal (2023) employed panel data analysis to examine the impact of human capital on economic growth in different Asian countries with various time periods. Comparing with panel data analysis, there are various empirical studies which employed time series analysis such as the work of Dahal (2016), Dangal and Gajurel (2019), Nasreen (2021), Rathanasiri (2020), Wang et al. (2019), Yoga et al. (2024), Zahan (2016) and so on. This study finds a gap in such a way that there are limited studies undertaking panel data analysis in case of Asian countries. Therefore, this study aims to examine the impact of human capital (basically

government expenditure on health, life expectancy at birth, government expenditure on education and secondary school enrollment) on economic growth of 48 selected Asian countries using annual data from 2014 to 2023. This study will contribute on the literature of human capital and economic growth in Asian countries.

The rest of the paper is organized into 5 sections. Section 2 is a literature review that covers theoretical and empirical studies on the relationship between human capital and economic growth. Section 3 describes the data and methodology that is employed to examine the impact of human capital on economic growth. Section 4 shows the results of the panel data analysis. Section 5 is the conclusion and discussion of the study.

2. LITERATURE REVIEW

This study reviewed various books, journal articles, conference papers and thesis. On that basis this study has classified the following themes: Theoretical foundation, Capital Formation, Population Growth and Economic Growth, Education and Economic Growth, and Health and Economic Growth for the literature review.

Theoretical Foundation

The academic study of economic growth was formally started in 1940 by American economist Domar and British economist Harrod. Economic growth, which usually is measured by GDP growth, indicates the expansion of a nation's productive capacity. Beckerman & Denison (1962) defined economic growth as an increase in real GDP or GDP per capita. Economic growth, which is regarded as an extended period of consistent GDP growth, may be influenced by a variety of factors.

In the 1960s and 1970s, the idea of skilled labor, referred to as human capital, was first used in economic studies. Given that a wide range of factors might influence the creation and use of human capital, each person voiced their own perspective on the topic (Goode, 1959; Mincer, 1958; Becker, 1962). These factors may have broad, favorable, or macroeconomically or macroeconomically important effects on the economy. In certain cases, the exogenous or endogenous components are classified using demographic, sociological, socio-demographic, economic, and ecological categories. The development of the endogenous growth hypothesis led to an increase in interest in human capital.

Researchers like Paul Romer, Trevor Swan, Joseph Schumpeter, Robert Solow, and others have made major contributions to our knowledge of the causes and mechanisms of economic growth.

Pioneered by Solow (1957) and Swan (1956), the neoclassical model is a notable theory that makes important contributions to contemporary growth theory. The population increase, saving rates, and technical advancements are all considered as exogenous growth determinants in Solow's model.

By incorporating human capital into their models, Lucas (1988) and Romer (1986) launched the field of study on human capital, which is still ongoing today. Schultz (1961) distinguished human capital from the conventional understanding of capital and acknowledged it as an investment in human knowledge. He also suggested that a labor force devoid of knowledge would not contribute to economic growth in contemporary societies.

Since Romer (1986) and Lucas (1988) introduced the endogenous growth hypothesis, innovation, knowledge, and human capital have gained significant recognition as the important drivers of economic growth. Such approaches included human capital as an input in the production function which primarily had functional relationships of labor inputs, capital inputs with outputs. Endogenous growth models indicate that ongoing improvements in education have a significant effect on output growth over the long run. Researchers strongly emphasis that the investment in the human capital has a positive knock-on effect on the economy. Romer (1990) included an additional element, the research and development component, to show how invention occurs and contributes to endogenous economic growth. On these theoretical foundation, Hanif and Arshed (2016), Pokhrel and Khadka (2019), Ndaombwa (2023) considered a mathematical model as economic growth is a function of gross fixed capital formation, population growth, government expenditure on health, life expectancy at birth, government expenditure on education and secondary school enrollment.

Capital Formation, Population Growth and Economic Growth

From the theoretical viewpoint and the empirical studies, capital input positively influences economic growth. Researchers usually consider gross fixed capital formation as the capital inputs, in the same way labor force and/or population aged between 15 to 64 years are considered as the labor inputs. As defined by Nurkse (1953) there will be an increase in the productive efficiency of the country by the formation of capital goods which enhance economic growth. Gross fixed capital formation measures spending on non-financial assets during a given period composed of acquisitions of producers less disposals in the process of the production of goods and services (Barro, 1991; Levine & Renelt, 1992). From the article of Solow (1957) along with the works of Romer (1986), Lucas (1988) and Mankiw et al. (1992), it is evident

that the population growth and capital formation together incorporate economic growth. Among several empirical studies, Boamah et al. (2018), Kesar et al. (2022), Gajurel and Dangal (2023), Duwal and Suwal (2024) conducting various studies assessed gross fixed capital formation and population growth which had direct relationship with the economic growth in 18 Asian countries from 1990 to 2017, in 5 countries from 1990 to 2017, in SAARC and ASEAN countries from 2001 to 2020 and in 18 Asian countries from 2012 to 2020 respectively. Aiyar and Ebeke (2016), Naby and Sallam (2016), Ajmair et al. (2018), Karki et al. (2024), Pokhrel and Khadka (2019) and Sethi et al. (2020) found positive relationship between gross fixed capital formation, population growth and economic growth. Similarly, Benhabib and Spiegel (2004), Doyle and Martinez-Zarzoso (2011), Mulok et al. (2011), and Mumuni and Njong (2023) urged additional investigation for notion that population growth causes economic growth since they did find causal relationship between them. Another domain of literature such as Thornton (2001), Yoga et al. (2024) and Zahan (2016) found a negative relationship between population growth and economic growth.

From these literature reviews on the association between capital formation, population growth and economic growth, it is found mixed results which are not consistent with the theoretical approach. In addition, there are few pieces of literature which employed panel data. Therefore, this study would articulate the positive influence of capital formation and population growth in the economic growth of Asian countries employing panel data analysis.

Health and Economic Growth

The existing literature on the relationship between health and economic growth is plentiful and most of the studies use government expenditure on health and life expectancy at birth which are directly associated with the economic growth (Akinwale, 2021; Ifa & Guetat, 2019; Mladenovic et al., 2016; Nasreen, 2021; Ogunjimi & Adebayo, 2019; Ozyilmaz et al., 2022; Piabuo & Tieguhong, 2017; Senol et al., 2021; Wang et al., 2019; Yuksel & Dincer, 2018). The findings were drawn from different estimation techniques; most of them were times series analysis, cross-country analysis and panel data analysis. Among all Piabuo and Tieguhong (2017) used panel data from 1995 to 2015 in African countries, Yuksel and Dincer (2018) used panel data from 1996 to 2016 in E-7 countries and Mladenovic et al. (2016) using panel data from 1974 to 2015 in 28 European countries. All these studies found that with the rise in health expenditure, the economies gained economic growth. Raghupathi and Raghupathi (2020), Wang et al. (2019) and Nasreen (2021) employed time series data of US, Pakistan and Turkey

respectively indicating mixed association between government expenditure on health and economic growth. Moreover, the results of Nasreen (2021), Sethi et al. (2020), Wang et al. (2019), along with Ifa and Guetat (2019) revealed a bidirectional causal linkage between health expenditure and economic growth. Such results demonstrate the complex and delicate relationship between health spending and economic growth, suggesting that certain national and local circumstances may influence how investments in health care affect economic development.

Similarly, other studies such as Akinwale (2021), He and Li (2020), Mabrouki (2022) Ogunkimi and Adebayo (2019), Opeloyeru and Lawal (2017), Senol et al. (2021) and so on investigated the relationship between health expenditure, life expectancy at birth, and economic growth. The results of Akinwale (2021) revealed that expenditure on health and life expectancy at birth positively influenced economic growth in the long run and short run in Nigeria. This study was consistent with the study of Ogunjimi and Adebayo (2019) referring to life expectancy at birth had a causal relationship with economic growth in Nigeria and Saudi Arabia. Mohamed (2022) found a stable long-run relationship between education, life expectancy at birth, population, and gross fixed capital formation with economic growth in Scandinavian countries. Senol et al. (2021) revealed a positive relationship of life expectancy at birth and health expenditure with economic growth. Similar positive relationships were revealed by the studies of He and Li (2020), and Opeloyeru and Lawal (2017). However, Lawal et al. (2023) found a significant and positive relationship between life expectancy and economic growth, but health expenditure had a significant and negative relationship with economic growth in Nigeria. Few other studies such as Keyifli and Recepoglu (2020) and Balaji (2011) found that expenditure on health by government had not influence economic growth in E7 countries and India. More than that, Eggoh et al. (2015) and Bats (2015) found a negative relationship between them in selected 49 countries and 17 OECD countries.

All this literature motivates to examine whether government expenditure on health and life expectancy at birth influence economic growth in Asian countries for the sample period 2014-2023 through panel data analysis.

Education and Economic Growth

The pioneers such as Robert Barro, Robert Lucas, Becker, Romer, Mankiw, Mincer and many more stress that education is the first step towards achieving economic development because it is essential to enhance a country's human capital and stimulate economic growth. Weiss (1995)

claimed that a person with a higher level of education and more experience earns more revenue, more output and more social benefits. UNESCO (1997) stated that investment in education basically in primary and secondary level provides higher net marginal social benefits than the investment in tertiary level of education and such investment is appreciable if both private and public initiate their investment. According to analyses of the effects of educational investment on nations by Pedroni (2002), and Psacharopoulos and Patrinos (2004), the influence of these expenditures is greater in Latin American, Asian, and African nations than it is in OECD nations. In line with them, Alexiou (2009) also incorporated the need for educational investment for the economic growth and development of the country.

Heckman (2000) looked into the connection between economic and social success and cognitive and non-cognitive skills for the nation's development and found that it is important to consider the entire policy portfolio of interventions collectively, including school-based policies, early interventions, and training programs, rather than focusing on one type of policy in isolation from the others. Rehmana et al. (2015) examined the relationship between economic growth and education and concluded that investments in education are necessary for economic advancement. Moreover, by raising per capita productivity, education lowers poverty. The study also showed a robust correlation between economic growth, education, and poverty. According to Riihelaninen (2013) analysis, there was a brief positive correlation between government spending on education and economic development in the European Union during the crisis. In order to ascertain the impact of educational expenditure on economic growth in eighteen Latin American nations, Kiran (2014) undertook a study of South American studies. The findings showed a cointegration relationship between growth and spending on education. Blankenau et al. (2007) found a correlation between long-term economic growth and education spending after looking at 23 industrialized nations.

Dahal (2016) found that higher education boosts economic growth and generates job opportunities and argues that the size and caliber of nation’s education system affects the labor force, governance, and working conditions. Between 1967 and 2011, Alatas & Cakir (2016) studied the connection between human capital and economic growth in 65 different countries which showed that years of schooling and educational returns had positive association with economic growth and development. In regards, they suggested that investments in health and education, especially in developing nations, are critical to economic effectiveness.

Benhabib and Spiegel (1994), in contrast, found a slight negative linkage between growth and education spending when they looked at the effect of investing in human capital on economic growth. Furthermore, Quiggin (1999) argued that education has a negative financial or economic effects and this causes economic growth to stall. They claimed that some governments have cut back on budgets and spending in the field of education. Devarajan et al. (1996) found that spending on education either has no effect at all on economic growth, which supports the findings of Benhabib and Spiegel (1994) and Quiggin (1999). Colombier (2009) revealed a weak relationship between economic growth and government spending on education. In a similar vein, Guandong (2016) observed a negative correlation between South Sudan's economic growth and government spending on education.

Most of the literature suggests that there is a positive relationship between education and economic growth, though few literatures are against it. From the theories to the empirical studies, this study believed that education would foster human capital and finally bring economic growth to the country, therefore, this study examines the relationship between education and economic growth of Asian countries with panel data.

The existing literature of the impact of human capital on economic growth provides substantial theoretical and empirical studies. From the literature review, this study finds mixed results of the previous empirical studies and cannot provide solid conclusions. Besides, from the prior knowledge, this study also finds limited studies which investigated the impact of human capital on economic growth of all Asian countries. Hence, further examination using panel data of Asian countries specifically from 2014 to 2023 can offer nuanced insights into the impact of human capital on economic growth to clarify those mixed findings of previous studies.

3. DATA AND METHODOLOGY

This study examined the impact of human capital on economic growth in 48 Asian countries a sample period of 10 years from 2014 to 2023 with a post-positivist perspective. Basically, this study examines the relationship between government expenditure on health, life expectancy at birth, government expenditure on education and secondary school enrollment, and economic growth in Asian countries. In addition, this study also assesses the impact of population growth, and gross fixed capital formation on economic growth.

Theoretical Framework

Since the deductive approach is predicated on a causal relationship between the variables, it will be used (Creswell, 2014). Therefore, this study will use causal comparative research

methodology and data on the factors of human capital and economic growth rate. Panel data ranging from 2014 to 2021 will be collected and analyzed according to purpose of the study.

The classical theory of the production function of labor and capital has been employed, in accordance with the endogenous growth model proposed by Lucas (1988) and Romer (1986) to analyze the impact of education expenditure on economic growth. It is expressed as:

$$Q = f(L, K, H) \quad (1)$$

Where L and K represent the units of labor and units of capital to produce Q units of output in the economy and H represents Human stocks in the equation (1). It is assumed that the production function is an increasing returns to scale. Furthermore, education and health promote efficiency, knowledge and inventions which ultimately contribute to the economic growth of a country.

The mathematical model that has been used to study the connection between human capital and economic growth as considered by Hanif and Arshed (2016), Pokhrel and Khadka (2019), and Ndaombwa (2023) can be presented in equation (2) which include additional indicators such as life expectancy at birth and secondary school enrollment.

$$GDP = f(GFCF, POP\_G, GEH, LEB, GEE, SSE) \quad (2)$$

Where GDP is Gross domestic product, GFCF is gross fixed capital formation, POP_G is population growth (population between the ages from 15 to 64), GEH is government expenditure on health, LEB is life expectancy at birth, GEE is government expenditure on education and SSE is secondary school enrollment.

Based on the theoretical model of economic growth, this study considered the following econometric model which is expressed as.

$$LNGDP_{it} = \beta_0 + \beta_1 LNGFCF_{it} + \beta_2 POP\_G_{it} + \beta_3 GEH_{it} + \beta_4 LEB_{it} + \beta_5 GEE_{it} + \beta_6 SSE_{it} + \varepsilon_t \quad (3)$$

Data Source

The data were extracted from the secondary sources from World Development Indicators (WDI), and Health Nutrition and Population Statistics (HNPS) of World Bank. The annual data of 48 Asian countries (Afghanistan, Armenia, Azerbaijan, Bahrain, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Cyprus, Georgia, Hongkong, India, Indonesia, Iran, Iraq, Israel, Japan, Jordon, Kazakhstan, Kuwait, Kyrgyz Republic, Lao PDR, Lebanon, Macao, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Oman, Pakistan, Philippines, Qatar, Saudi Arabia,

Singapore, South Korea, Sri Lanka, Syria, Tajikistan, Thailand, Timor-Leste, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Vietnam and Yemen) covering the period 2014 to 2023 were employed in this study. The definitions and sources are provided in Table 1.

Table 1: Description of the Variables

Variables	Explanation	Sources
LNGDP	Natural logarithm of Gross Domestic Product, at constant price 2015 US $	WDI (2024)
LNGFCF	Natural logarithm of Gross Fixed Capital Formation at constant price 2015 US $	WDI (2024)
POP_G	Population Growth	WDI (2024)
GEH	Government Expenditure on Health (percentage of GDP)	HNPS (2024)
LEB	Life Expectancy at Birth	HNPS (2024)
GEE	Government Expenditure on Education (percentage of GDP)	WDI (2024)
SSE	Secondary School Enrollment (percentage gross)	WDI (2024)

4. RESULTS

The results of panel data analysis of 48 Asian countries consist of descriptive statistics, inferential statistics, and regression. It was found that the panel data are unbalanced panels.

Descriptive Statistics

The summary of descriptive statistics is presented in Table 2 to examine 205 number of observations 48 panels over 10-year annual data set. The average value of LNGDP was 25.56 with maximum and minimum values 29.15 and 21.16 with a standard deviation of 2.02, left skewness (-0.34), it is mildly peaked (2.23). The average of LNGFCF was 24.23, where the maximum and minimum values were 27.77 and 19.52 with the standard deviation of 1.99, left-skewed (-0.22) and it is mildly peaked (2.18). The average value of POP_G was 1.1 where maximum and minimum values were 3.85 and -4.17 with a standard deviation of 0.88, left-skewed (-0.84) and it is heavily peaked (9.17). The mean GEH was 2.71 where the maximum and minimum values were 9.34 and 0.39 with a standard deviation of 1.78, right skewness (1.91) and it was heavily peaked (7.58). The mean of LEB was 74.51 where the maximum and

minimum values were 84.56 and 65.28 with a standard deviation of 5.17 right skewness (0.40) and it was mildly peaked (2.06).

Table 2: Summary of Descriptive Statistics

Variable	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Obs
LNGDP	25.556	29.153	21.163	2.017	-0.338	2.299	205
LNGFCF	24.225	27.774	19.516	1.991	-0.220	2.177	205
POP_G	1.076	3.845	-4.170	0.877	-0.842	9.168	205
GEH	2.708	9.340	0.388	1.777	1.914	7.508	205
LEB	74.509	84.560	65.284	5.171	0.399	2.057	205
GEE	3.904	7.660	1.508	1.325	0.548	2.515	205
SSE	90.699	130.934	33.214	17.334	-1.076	4.800	205

Note: Author's own calculation.

The mean of GEE was 3.90 where the maximum and minimum values were 7.66 and 1.51 with a standard deviation of 1.33, right skewness (0.55) and it is mildly peaked (2.52). The mean of SSE was 90.70 where the maximum and minimum values were 134.93 and 33.21 with a standard deviation of 17.33, left-skewed (-1.08) and it is mildly peaked (4.80).

Panel Unit Root Test

This study followed the panel unit root test for determining the stationarity of the variables of the model and the result is presented in Table 3. The null hypothesis is that the variables have a unit root.

Table 3: Panel Unit Root Test

Variables	Assumes common unit root process	Assumes individual unit root process			Remarks
	Levin, Lin & Chu t*	Im, Pesaran and Shin W-stat	ADF-Fisher Chi-Square	PP-Fisher Chi-square	
LNGDP			163.6376**	156.0121***	I (0)

			(0.000)	(0.0001)	
LNGFCF			146.9209***	110.8443***	I (0)
			(0.0000)	(0.0056)	
POP_G	-25.3114***	-8.3524***	589.0986***	177.3021***	I (0)
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
GEH			280.3194***	150.340***	I (0)
			(0.0000)	(0.0000)	
LEB	-17.9738***	0.8742	152.5357***	120.6897**	I (0)
	(0.0000)	(0.8090)	(0.0002)	(0.0450)	
GEE			139.5513***	240.5420***	I (0)
			(0.0000)	(0.0000)	
SSE			180.3225***	174.9048***	I (0)
			(0.0000)	(0.0000)	

Note: Author's own calculation. *, ** and *** refers significance at 10%, 5% and 1% respectively.

Table 3 displays that all variables, LNGDP, LNGFCF, POP_G, GEH, LEB, GEE, and SSE are stationary at level. This result suggests that this study need not go for the dynamic panel data model.

Correlation Analysis

The degree and direction of the relationship between independent variables and dependent variable are studied with the help of a correlation matrix as in Table 4. This correlation matrix provides information about the pairwise correlations between different variables. The values range from -1 to 1, where 1 indicates a perfect positive correlation, 0 indicates no correlation, and -1 indicates a perfect negative correlation.

Table 4: Correlation Matrix

	LNGDP	LNGFCF	POP_G	GEH	LEB	GEE	SSE
LNGDP	1						
LNGFCF	0.992	1					
POP_G	-0.168	-0.155	1				
GEH	0.194	0.187	-0.238	1			
LEB	0.385	0.371	-0.270	0.628	1		
GEE	-0.283	-0.249	0.189	0.302	0.101	1	
SSE	0.129	0.144	-0.217	0.440	0.635	0.215	1

Note: Author's own calculation.

Table 4 reports that there is a very strong positive correlation (0.99) between LNGDP and LNGFCF which suggests that there is a high degree of association between these two variables. However, there is a weak and negative relationship between POP_G and LNGDP, and GEE and LNGDP respectively. There is a weak and positive relationship between GEH and LNGDP, LEB and LNGDP, and SEE and LNGDP respectively. It is furthermore found that LEB and GEH, and LEB and SSE have a strong positive relationship which might invite multicollinearity problems in the data set. Therefore, the diagnostic test was essential to be carried out in the study.

Diagnostic Tests

For the reliability of the data set, several diagnostic tests such as normality test, heteroscedasticity test and serial correlation test were employed. For testing the data are normal distribution, the Jarque-Bera normality test was employed, for heteroscedasticity, the imtest was employed and for serial correlation, the variance inflation factor was employed.

Normality Test

The null hypothesis (Ho) for the Jarque-Bera test is that the residuals of the regression model are normally distributed. The JB residual value is 6.684 with p-value 0.058. The p-value is

greater than the significance level (0.05). Therefore, the residuals appear to be normally distributed.

Multicollinearity Test

The multicollinearity in the data was measured by Variance Inflation Factor (VIF) on how much the variance of an estimated regression coefficient increases if the predictors are correlated. The result of VIF is shown in Table 5.

Table 5: VIF

Variable	VIF	1/VIF
LEB	2.57	0.39
GEH	1.89	0.53
SSE	1.77	0.56
GEE	1.37	0.73
LNGFCF	1.29	0.77
POP_G	1.19	0.84
Mean VIF	1.68	

Note: Author's own calculation.

From Table 5 it was found that all variables LNGDP, LNGFCF, POP_G, GEH, LEB, GEE and SSE have relatively low values of VIF. These all indicate that there is the least degree of multicollinearity. Thus, this study assures there is no evidence of multicollinearity problem.

Heteroskedasticity Test

The heteroskedasticity test is conducted whether there is homoskedasticity in the residuals in the model or not by employing white's test. The chi-squared test statistics are 114.52 and the degree of freedom (df) was reported as 34. The probability (prob>chi2) value is 0.0000 (<0.05). This implied that there was evidence of heteroskedasticity in the data. The details are shown in Table 6.

Table 6: Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	P-value
Heteroskedasticity	114.52	27	0.0000
Skewness	19.53	6	0.0034
Kurtosis	4.77	1	0.0289
Total	138.83	34	0.0000

Note: Author's own calculations.

From Table 6, it was found that the p-value (0.0000) is the lowest, suggesting that there is significant evidence to reject the null hypothesis of homoskedasticity.

Random Effect Model or Fixed Effect Model

The Hausman test is used to choose the fixed effect model (FEM) or random effect model (REM). The null hypothesis is that the fixed effect model is the best to describe the panel data. Otherwise, REM is the best. If the p-value is less than 0.05, then FEM is more appropriate and if the p-value is more than 0.05, then REM is more appropriate. The result of the Hausman test is presented as in table 7.

Table 7: Result of Hausman test

Variable	Coefficients			
	(b) Fixed	(B) Random	(b-B) Difference	Sqrt(diag(V_b-V_B)) S.E.
LNGFCF	0.298	0.790	-0.492	0.019
POP_G	-0.025	-0.026	0.001	-
GEH	0.043	0.020	0.023	-
LEB	0.025	0.015	0.011	-
GEE	-0.036	-0.063	0.027	-
SSE	0.005	0.001	0.004	-

Note: Authors' own calculation. b = consistent under H_0 and H_a; obtained from xtreg, B = inconsistent under H_a, efficient under H_0; obtained from xtreg.

From the result of Table 7 the appropriate model for this study was the Fixed Effect Model (FEM) since the p-value of FEM was 0.0000 (<0.05) with chi2 (6) value as 654.24.

From Breusch and Pagan Lagrangian multiplier test for random effects and pooled OLS, the p-value was 0.0000 (<0.05). Therefore, this study rejects pooled OLS model and confirmed FEM is the best model which describes the relationship between human capital and economic growth in 48 Asian developing countries for the selected sample period.

Furthermore, when the model was checked by the modified Wald test for groupwise heteroskedasticity in the Fixed effect regression model, where the null hypothesis of sigma(i) square as the sigma square for all I, the chi-square (32) value was 4.2e27 with the p-value of 0.0000 (<0.05) indicating the presence of heteroskedasticity in the data.

Therefore, the relationship between independent variables and dependent variables was examined using robust FEM which is presented in Table 8.

Table 8: Results of Fixed Effect Model

Variable	Fixed Effect Model				Robust Fixed Effect Model			
	Coeff.	Std. Err.	t	P>|t|	Coeff.	Std. Err.	t	P>|t|
LNGFCF	0.298	0.036	8.390	0.000	0.298	0.089	3.330	0.002
POP_G	-0.025	0.010	-2.560	0.011	-0.025	0.009	-2.900	0.007
GEH	0.043	0.009	4.680	0.000	0.043	0.023	1.900	0.067
LEB	0.025	0.008	3.250	0.001	0.025	0.012	2.160	0.039
GEE	-0.036	0.011	-3.210	0.002	-0.036	0.019	-1.920	0.065
SSE	0.005	0.001	3.660	0.000	0.005	0.002	2.150	0.039
Constant	16.022	0.901	17.780	0.000	16.022	1.741	9.200	0.000
Prob>F		0.0000		Sigma_u	1.339			
R-squared within		0.5418		Sigma-e	0.0669			
R-squared between		0.8903		Rho	0.9975			

R-squared overall	0.8841

Note: Author's own calculation.

All variables are statistically significant. LNGFCF, GEH, LEB and SSE have a positive and statistically significant relationship with LNGDP. One percent rise in LNGFCF increases 0.30 percent in LNGDP. The findings indicate that an increase in government expenditure on health significantly boosts economic output. Specifically, a one-unit rise in GEH is associated with a 0.04 unit increase in LNGDP. Similarly, it is also found that there is a strong positive relation between life expectancy at birth and economic growth. One unit increase in life expectancy at birth increases 0.03 unit increase in LNGDP. This substantial impact underscores the importance of long-term health and wellness on economic stability and growth. The results also display a positive relationship between secondary school enrollment and LNGDP, although modest, indicates that education plays a critical role in economic development. A one-unit rise in SSE leads to a 0.005 unit increase in LNGDP. Interestingly, the study finds that population growth has a negative and significant impact on LNGDP. A one-unit increase in population growth decreases LNGDP by 0.03 units. This inverse relationship could be attributed to the strain that rapid population growth places on resources, infrastructure, and public services. Contrary to expectations, the results indicate a negative relationship between government expenditure on education and LNGDP. This suggests that a one-unit rise in GEE decreases 0.04 units in LNGDP, which could reflect inefficiencies or misallocation of educational resources.

5. CONCLUSION AND DISCUSSIONS

This article examines the impact of human capital on the economic growth of 48 Asian countries the period 2014 – 2023. From 205 number of observations, 10 number of time and 48 number of panels, the fixed effect model (FEM) is the best estimator to explain the relationship between human capital and economic growth. The study employes the 6 steps of estimation technique; descriptive statistics, panel unit root test, correlation matrix, diagnostic test, Hausman test and Breusch and Pagan Lagrangian multiplier test, FEM estimation, and robust FEM estimation. This study considers government expenditure on health (Becker, 1962; Lucas, 1988), life expectancy at birth (Aghion & Howitt, 2005), government expenditure on education (Barro & Lee, 1993; Benhabib & Spiegel, 1994; Quiggin, 1999) and secondary school enrollment (Barro, 1991; Mankiw et al., 1992; Levine & Renelt, 992), as the measurement of human capital.

The results from the FEM and robust FEM show that government expenditure on health has a positive and significant influence on economic growth of Asian countries. This result is consistent with several previous studies on the association between government expenditure on health and economic growth such as Akinwale (2021) in Saudi Arabia and Nigeria, Mladenovic et al. (2018) in 28 European countries, Piabuo and Tieguhong (2017) in 11 African countries; Yuksel & Dincer (2018) in E-7 countries, Wang and Wong (2011) in 31 countries. Furthermore, the results reveal unidirectional relationship between them against of the findings of Wang et al. (2019) in Pakistan, Nasreen (2021) in Turkey and Sethi et al. (2020) in 10 Eurasian countries. Similarly, the positive and significant relationship between life expectancy at birth and economic economic growth, which is found by this study is consistent with the previous studies such as He and Li (2020) in 65 countries, Lawal et al. (2023) in Nigeria, Mohamed (2022) in Scandinavian countries, and Opeloyeru and Lawal (2017) in Nigeria. Both the increase in government spending on health and life expectancy at birth boost people to be engaged in the productive sector which invites economic growth.

Similarly, this study reveals a positive and significant association of secondary school enrollment and economic growth in 48 Asian countries. Such results confirm that this study is consistent with the theories and previous studies such as Alatas and Cakir (2016) in 65 countries, Dahal (2016) in Nepal, Johnson (2011) in Nigeria, Kiran (2014) in 18 Latin American countries, Hanif and Arshad (2016) in 8 SAARC countries, and Duwal and Archaya (2023) in Nepal. However, this study is not consistent with the results of the relationship between government expenditure on education and economic growth. Kiran (2014), Blankenau et al. (2007), Alatas and Cakir (2016), Rathanasiri (2020), Mukhtarov et al. (2020) and many more studies found a positive and significant relationship between government spending on education and economic growth. But there are many other studies which are not consistent with such results. Empirical studies such as Colombier (2009) in OCED countries, Dangal and Gajurel (2019) in Nepal, Duwal and Acharya (2023) in Nepal, Guandong (2016) in China, Mumuni and Njong (2023) in 31 Sub-Saharan African countries, Quiggin (1999) in Australia and New Zealand and so on report a negative relationship between them. It is because most of the Asian countries are facing political, economic and social problems. The complicated administrative and bureaucratic system hinders the implementation of government's programs.

This study does not leave behind to show the relationship between gross fixed capital formation and population growth, and economic growth. The results show that there is positive and significant relationship between gross fixed capital formation and economic growth which is

consistent with previous studies such as Boamah et al. (2018) in 18 Asian countries, Duwal and Suwal (2023) in 18 Asian countries, Kesar et al. (2022) in 5 countries, Gajurel and Dangal (2023) in SAARC and ASEAN countries, Sore et al. (2024) in 42 Sub-Saharan African countries and so on. However, this study shows a negative and significant relationship between population growth and economic growth which is not consistent with previous studies such as Aiyar and Ebeke (2016), Benhabib and Spiegel (2004), Doyle and Martinez-Zarzoso (2011), Kesar et al. (2022) and Mulok et al. (2011). Albeit Thornton (2001) in Latin American countries, Yoga et al. (2024) in Indonesia, Zahan (2016) in Bangladesh and Yang et al. (2021) in 186 countries found negative and/or inconsistent relationship between population growth and economic growth. It can be argued that population growth increases household expenditure, and more time devoted to family members, reducing the working hours in the productive sector. In addition, most of the Asian countries have cultural and religion barriers to participate in work force. There is still the problem of the vicious cycle of poverty in many Asian countries.

This study reveals that government spending on health, life expectancy at birth, school enrollment and capital formation boost up economic growth in Asian countries. It is implied that such spending on health and education by the government is vital for enhancing productivity and economic growth of the nations. On the contrary, this study finds that the government expenditure on education and population growth in Asian countries has negative influence on their economic growth, which display potential inefficiencies of these countries to challenge population growth and misallocation of resources. Majorly, this study significantly exhibits the impact of human capital on the economic growth of Asian countries. This research contributes not only to the literature of human capital and panel data analysis but also spreads the understanding of the role of government spending on health and education for the economic growth of the nation. It is suggested that Asian countries should implement population management, which is the real strength and assets and increase the effectiveness and efficiency of government spending so that they can achieve consistent economic growth. There are numerous possibilities of research on the role of education and health on economic growth such as taking every long time, finding new proxies for education and health and so on.

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