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Human Capital Dynamics and Economic Growth: A Panel Data Analysis of Eleven Countries

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Abstract

The relationship between human capital and economic growth is a critical concern for policymakers and economists. This study utilizes panel data analysis to investigate this relationship across eleven countries from 1992 to 2016. Panel data analysis offers insights into both cross-sectional and time-series variations, enabling a comprehensive examination of human capital dynamics and economic growth over time. By employing panel data techniques, researchers can control for country-specific characteristics and time trends, yielding more robust estimates. The study focuses on assessing the impact of indicators such as education attainment, health outcomes, and skills development on economic growth. Longitudinal data analysis allows observation of how changes in human capital accumulation correspond to economic performance. Additionally, subgroup analyses enable exploration of heterogeneity in this relationship across countries and regions. Key indicators include Gross Domestic Product (GDP) for economic performance and variables such as investment, net secondary school enrollment, health expenditures, total labor force, and life expectancy at birth for human capital assessment. These indicators offer insights into investment levels, educational attainment, healthcare resources, workforce size, and population health, respectively.

Keywords: Human Capital, Economic Growth, Panel Data Analysis, Education Attainment, Health Outcomes

JEL Codes: O15, O40, I25, J24, C23

1. INTRODUCTION

In recent years, the Pakistan economy has shown signs of growth, surpassing the growth rates of low-income and middle-income countries by 5%. The government under General Musharraf's leadership expanded opportunities in the macroeconomic sector, contributing to this positive trend. However, despite this progress, Pakistan's economic growth still lags behind that of high-developing countries. Several factors contribute to this disparity, with investment levels and human capital being among the most significant. In particular, the education sector plays a crucial role in shaping human capital and driving economic development. Unfortunately, Pakistan's education system has not experienced the necessary growth and improvement. According to Barrow and Lee (2000), the quality of Pakistan's schooling system is notably lower compared to South Asian and Southeast Asian countries. One of the challenges in Pakistan is the affordability and accessibility of education. While the country provides a relatively inexpensive education system, the quality often falls short of international standards. This disparity in education quality can hinder human capital development and limit the country's economic potential. Moreover, poverty remains a pressing issue in Pakistan, with approximately 30% of the population living below the poverty line. Economists and researchers continue to seek effective strategies to alleviate poverty and improve living conditions for the population. Addressing these socio-economic challenges, particularly in education and poverty alleviation, will be crucial for Pakistan's sustained economic growth and development in the future. Easterly and Levine (2001) as well as Temple (2001) conducted studies examining the relationship between years of schooling and variations in economic growth. However, both studies concluded that they did not find a significant relationship between these variables. Despite the widespread belief that education plays a crucial role in fostering economic growth, the findings of these studies suggest that the link between years of schooling and economic growth may not be as straightforward as previously thought.

The absence of a clear relationship between education and economic growth in these studies highlights the complexity of the relationship between human capital accumulation and economic development. While education is widely recognized as a key determinant of long-term economic success, other factors such as institutional quality, technological innovation, and macroeconomic stability may also play significant roles in driving economic growth. These findings underscore the need for further research to better understand the mechanisms through which education influences economic outcomes. Additionally, policymakers should consider a holistic approach to promoting human capital development, focusing not only on increasing educational attainment but also on improving the quality of education, enhancing skills training programs, and addressing barriers to education access. Despite the inconclusive findings of these studies, the importance of education in fostering socio-economic development remains undeniable. While the direct impact of years of schooling on economic growth may be

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ambiguous, investments in education can yield numerous social and economic benefits, including poverty reduction, improved health outcomes, and enhanced productivity. Therefore, policymakers should continue to prioritize investments in education as part of broader efforts to promote inclusive and sustainable development. Bosworth and Collins (2003) similarly encountered challenges in establishing a robust link between educational quality and economic growth. They found it difficult to distinguish the impact of learning quality from more general concepts of institutional quality. This suggests that while education is undoubtedly important, its effects on economic growth may be intertwined with broader institutional factors. Some researchers argue that the association between education and growth is fragile, particularly when considered in isolation. Simply acquiring skills may not lead to economic benefits if the necessary infrastructure and institutions are lacking to utilize them effectively. In essence, human capital development must be complemented by investments in infrastructure and the establishment of strong institutional frameworks to fully realize its potential contribution to economic growth. Moreover, studies have shown that periods of rapid economic growth, or growth accelerations, are often accompanied by various other factors. These include increases in investment and trade, real exchange rate depreciations, and even political regime changes. These findings suggest that economic growth is a complex phenomenon influenced by multiple interconnected factors, with education serving as just one piece of the puzzle. Therefore, while investments in education remain essential for human capital development, policymakers must adopt a holistic approach to promoting economic growth. This approach should include investments in infrastructure, improvements in institutional quality, and other supportive measures to create an enabling environment for sustainable development. By addressing these complementary factors alongside investments in education, countries can maximize their potential for long-term economic prosperity.

Bosworth and Collins (2003), Abed and Devoid (2004), and Kemal, Musleh-ud Din, and Qadir (2002) have all come to a similar conclusion: mere increases in production cannot fully account for economic growth. Their research suggests that economic growth is a multifaceted phenomenon influenced by various factors beyond just production output. To better understand the role of human capital in economic growth, different proxies have been utilized. These proxies include investment, gross secondary school enrollment, health expenditures, total labor force, and life expectancy at birth. By considering these diverse indicators, researchers aim to capture the broader spectrum of human capital development, recognizing that economic growth is not solely dependent on increases in production, but also on investments in education, health, and workforce development. Furthermore, inflation is often used as a proxy variable to gauge the effectiveness of economic policies and the overall quality of institutions. Inflation can reflect the success or failure of economic plans, as well as the efficiency and stability of organizations within an economy. Therefore, by incorporating inflation as a proxy variable, researchers can assess how economic policies and institutional quality influence economic growth and development.

2. LITERATURE REVIEW

Sheiner (2014) conducted a study to analyze the perspectives on Health Care Spending Growth from 1960 to 2012. Utilizing econometric techniques such as integration regression growth per capita, the study aimed to measure the relationship between economic growth, health expenditure, and inflation over the specified time period. The findings of the study revealed that economic growth was lower compared to health expenditure and inflation during the period under investigation. This suggests that health care spending grew at a faster rate than the overall economic growth, indicating a significant portion of resources being allocated to the healthcare sector relative to the overall economy. The implications of these findings may have important implications for policymakers and healthcare stakeholders. A disproportionate increase in health care spending relative to economic growth could pose challenges for fiscal sustainability and resource allocation in the long run. Moreover, understanding the dynamics between economic growth and health care spending is crucial for formulating effective health care policies and ensuring equitable access to healthcare services while maintaining fiscal prudence.

Sghari and Hammami (2013) conducted a study to examine the relationship between health expenditure and Gross Domestic Product (GDP) in developed countries from 1975 to 2011. Employing econometric techniques such as long-run causality test, Granger causality, and vector autoregressive analysis, the study aimed to assess the nature of the relationship between health expenditure and economic growth over the specified time period. The findings of the study indicated that there existed a stable long-run relationship between increases in health care expenditure and economic growth in developed countries. Furthermore, the study revealed a positive relationship between health expenditure and economic growth, suggesting that higher levels of health care spending were associated with increased economic growth in these countries. These findings have significant implications for policymakers and healthcare stakeholders in developed countries. Investing in healthcare infrastructure and services may not only contribute to improving public health outcomes but also stimulate economic growth by creating jobs, enhancing productivity, and fostering innovation in the healthcare sector. Therefore, policies aimed at increasing health expenditure could be beneficial not only for health outcomes but also for overall economic development.

Anyanwu and Erhijakpor (2009) conducted a study to examine the relationship between health expenditures and health outcomes in Africa from 1994 to 2004. Employing econometric techniques such as panel data regression equations for under-five mortality and infant mortality, the study aimed to assess the impact of health expenditure on health outcomes in the region. The findings of the study revealed an unambiguously negative relationship between per capita total and government expenditure on health and health outcomes. Additionally, the coefficients associated with these relationships were found to be significant. This suggests that higher levels of health expenditure were associated with improved health outcomes, particularly in terms of reducing under-five mortality and infant mortality rates. Despite the advocacy for greater expenditure

on health outcomes, empirical evidence supporting the beneficial impact of such expenditure on infant and child mortality has been limited. However, the findings of this study provide empirical support for the positive impact of health expenditure on reducing mortality rates among infants and children in Africa. These findings underscore the importance of investing in healthcare infrastructure and services in Africa to improve public health outcomes, particularly among vulnerable populations such as infants and children. Policymakers and healthcare stakeholders can use this evidence to prioritize and allocate resources effectively to address healthcare challenges and improve health outcomes in the region.

Ramesh and Nishant (2004) conducted a study to estimate the time series analysis of private healthcare expenditures (PHE) as a proportion of Gross Domestic Product (GDP) from 1960 to 2003. Employing econometric techniques such as the ordinary least squares method, unit root tests, and co-integration analysis, the study aimed to measure the relationship between private healthcare expenditures and GDP, considering potential structural breaks in the time series data. The findings of the study revealed that both per capita income (PCI) and private healthcare expenditures were not stationary in their level. This implies that these variables exhibited trends over time rather than remaining constant. Additionally, the null hypothesis of unit root was rejected, indicating that these variables were stationary after differencing. The presence of structural breaks in the time series data suggests that certain significant changes occurred in the relationship between private healthcare expenditures and GDP during the study period. By considering these structural breaks, the study provided a more nuanced understanding of the dynamics between private healthcare expenditures and economic growth over time.

Khan and Ssnhadji (2001) conducted a study to estimate the threshold effects in the relationship between inflation and growth from 1960 to 1998. Employing econometric techniques such as panel data log likelihood ratio tests, the study aimed to measure the nuanced relationship between inflation and economic growth over the specified time period. The findings of the study revealed the existence of threshold effects in the relationship between inflation and growth. By utilizing new econometric techniques that provide appropriate procedures for estimation and inference, the study identified a critical threshold beyond which inflation exerts a negative effect on economic growth. This implies that moderate levels of inflation may not significantly hinder economic growth, but once a certain threshold is surpassed, inflation begins to impede growth. These empirical results have important implications for monetary policy and economic management. They suggest that policymakers should be cognizant of the threshold level of inflation beyond which its adverse effects on growth become pronounced. By maintaining inflation rates below this threshold, policymakers can help support sustainable economic growth and development.

Attari and Javed (2013) conducted a study to estimate the relationship between inflation, economic growth, and government expenditure in Pakistan from 1980 to 2010. Employing econometric techniques such as the Augmented Dickey Fuller (ADF) unit root test, Autoregressive Distributed Lag (ARDL) modeling, Johansen co-integration analysis, and Granger-causality tests, the study aimed to measure the complex interplay between these variables. The findings of the study revealed a negative relationship between GDP and inflation, suggesting that higher levels of inflation were associated with lower economic growth in Pakistan. Additionally, the estimated relationship between real income and government expenditure was found to be positive. This positive association between real income and government expenditure mirrored findings from other countries such as Australia, Canada, Finland, New Zealand, Spain, Sweden, and the United Kingdom. These findings have significant implications for policymakers in Pakistan. By understanding the relationships between inflation, economic growth, and government expenditure, policymakers can design more effective monetary and fiscal policies aimed at promoting sustainable economic development. Furthermore, the study contributes to the empirical literature on macroeconomic dynamics by providing insights into the relationships between key variables in the context of Pakistan's economy.

Gokal and Hanif (2004) investigated the relationship between inflation and economic growth in Fiji from 1970 to 2001. Employing econometric techniques such as non-linear least squares (NLLS) methods, the study aimed to explore the nuanced dynamics of this relationship. The findings of the study revealed the presence of a threshold effect in the relationship between inflation and economic growth. Specifically, the study identified a critical threshold beyond which inflation exerts a negative effect on growth. Inflation levels below this threshold were found to have no significant effect on growth, indicating a certain level of tolerance for inflation without detrimental effects on economic growth. However, once inflation rates surpassed the threshold, they were found to have a significant negative impact on growth. These findings have important implications for monetary policy and economic management in Fiji. By identifying the threshold level of inflation beyond which its adverse effects on growth become pronounced, policymakers can implement targeted measures to maintain inflation rates within acceptable bounds. Additionally, the study contributes to the empirical literature by highlighting the non-linear nature of the relationship between inflation and economic growth, underscoring the need for nuanced policy responses.

Asari et al. (2011) conducted a comprehensive analysis of the correlation between inflation rate, employment rate, and Gross Domestic Product (GDP) in Malaya from 1982 to 2006 using multivariate time series analysis. Employing various econometric techniques such as unit root tests, co-integration tests, trace tests, maximal eigenvalue tests, vector error correction models, and Granger causality tests, the study aimed to explore the intricate relationships among these key macroeconomic variables. The findings of the study revealed several important insights into the dynamics of inflation, employment, and GDP in Malaya. Firstly, the study identified that both inflation rate and employment rate exerted significant influences on GDP in the short run. This suggests that changes in inflation and employment levels can have immediate effects on the overall economic output of the country. Furthermore, the study found that GDP was unable to significantly affect inflation, indicating a unidirectional relationship where changes in GDP do not have a substantial impact on inflation levels.

Additionally, a negative relationship between employment and GDP was observed in the long run, suggesting that higher levels of employment may not necessarily lead to proportionate increases in GDP over extended periods. These findings have important implications for policymakers and economic analysts in Malaya. By understanding the complex interplay between inflation, employment, and GDP, policymakers can design more targeted and effective policies aimed at promoting economic stability and sustainable growth. Additionally, the study contributes to the empirical literature by providing insights into the specific dynamics of the Malayan economy and highlighting the factors influencing its economic performance.

Ocaya, Ruranga, and Kaberuka (2012) conducted an in-depth analysis of the dynamic relationship between gross domestic product (GDP) and domestic investment (DI) in Rwanda spanning from 1970 to 2011. Utilizing various econometric techniques such as unit root tests, Granger Causality tests, co-integration analysis, Vector Auto-regression (VAR), and Vector Error Correction Model (VECM), the study aimed to elucidate the intricate interplay between GDP and DI in the Rwandan context. The findings of the study revealed several noteworthy insights into the relationship between GDP and DI in Rwanda. Firstly, the study identified a unidirectional causality, indicating that policies aimed at stimulating GDP growth provide crucial insights for predicting DI levels in the country. This suggests that changes in GDP have a significant impact on domestic investment activities in Rwanda. Furthermore, the results of the estimation of the bivariate VAR model, combined with Granger causality tests and error correction model, emphasized the importance of the DI equation in the adopted model, while highlighting the relative irrelevance of the GDP equation. This underscores the pivotal role of domestic investment in driving economic activity and growth in Rwanda. Moreover, the study found that the estimated bivariate VAR model was stable in first differences but not in levels. This indicates the necessity of analyzing changes in GDP and DI over time rather than focusing solely on their absolute levels. Interestingly, the study also conducted forecasts for DI, revealing that the forecasted value of DI in 2011 closely matched the actual value, with a small error margin of 0.0697%. This suggests that GDP can effectively predict DI levels in Rwanda with a high degree of accuracy. The small difference between the forecasted and actual values of DI was attributed to the commendable policies implemented by the Rwandan government and the private sector federation to promote investment in the country. This underscores the importance of proactive policy measures in driving economic development and attracting domestic investment.

Mofrad (2012) delved into the intricate relationship between GDP and investment in Iran spanning from 1991 to 2008. Employing robust econometric techniques such as unit root tests and Johansson co-integration tests, the study aimed to elucidate the long-term dynamics between these crucial economic variables. The findings of the study revealed a significant long-term relationship between investment, export, and gross domestic production (GDP) in Iran. Notably, the analysis unveiled a positive and statistically significant correlation between investment and GDP at a 95% confidence level. This suggests that increases in investment levels in Iran tend to coincide with corresponding expansions in GDP over the long term, indicating a symbiotic relationship between investment activity and overall economic output. However, the relationship between investment and export exhibited a negative correlation, implying that higher levels of investment in Iran may be associated with decreases in export activity. This unexpected finding warrants further exploration and may indicate potential complexities within the Iranian economy's investment-export dynamics. Furthermore, the study conducted an analysis of the vector error correction model (VECM) for GDP, revealing a negative error correction coefficient. This suggests that deviations of GDP from its long-term equilibrium value are corrected over time, with GDP converging towards its equilibrium level. The presence of a negative error correction coefficient indicates that short-term fluctuations in GDP tend to be higher than the long-term equilibrium value, reflecting the economy's adjustment process towards equilibrium.

Guech, Heang, and Moolio (2013) conducted an in-depth analysis of the relationship between Gross Domestic Product (GDP) and investment in Cambodia spanning from 1993 to 2011. Employing a comprehensive set of econometric techniques including simple regression analysis, Augmented Dickey-Fuller test, Durbin-Watson test, Breusch-Godfrey Serial Correlation LM test, Breusch-Pagan-Godfrey test, and Jarque-Bera test, the study aimed to elucidate the dynamics between these crucial economic variables. The findings of the study unveiled a positive relationship between investment and GDP in the long run within the context of Cambodia. This suggests that increases in investment levels in Cambodia tend to be associated with corresponding expansions in GDP over the long term, indicating a symbiotic relationship between investment activity and overall economic output. However, the study also highlighted that Cambodia may benefit relatively less from Foreign Direct Investment (FDI) due to internal factors within the country. Compared to other countries examined in the study, Cambodia may experience lower benefits from FDI inflows, indicating potential challenges or constraints within the domestic economic environment that may limit the full realization of FDI benefits. By employing a rigorous econometric methodology, Guech, Heang, and Moolio (2013) provided valuable insights into the economic dynamics of Cambodia, particularly regarding the relationship between investment and GDP. The study's conclusions underscore the importance of understanding the internal factors and external influences shaping Cambodia's economic landscape, offering implications for policymakers, investors, and researchers seeking to navigate and understand the Cambodian economy's complexities.

Fatima et al. (2011) conducted a comprehensive analysis to examine the relationship between private investment, economic growth, and fiscal deficit in Pakistan spanning from 1980 to 2009. Employing rigorous econometric techniques including Unit Root Test, Dickey-Fuller (DF), and Augmented Dickey-Fuller (ADF) tests, the study aimed to assess the stationarity of the data and explore the dynamic interactions among the variables of interest. The findings of the study revealed compelling insights into the repercussions of fiscal deficit on economic growth, both directly and indirectly. The analysis indicated that all series strongly rejected the unit root null hypothesis at a 5 percent significance level, suggesting a stable underlying trend

in the data over the specified time period. Specifically, the study identified a negative and significant impact of fiscal deficit on private investment (INV). This suggests that fiscal deficit, as a measure of government spending exceeding its revenue, exerts a detrimental effect on private investment activities in Pakistan. Such findings underscore the importance of fiscal prudence and effective management of government finances to foster an environment conducive to private sector investment and economic growth. By shedding light on the intricate relationship between fiscal deficit, private investment, and economic growth in Pakistan, Fatima et al. (2011) provided valuable insights for policymakers, economists, and stakeholders involved in shaping the country's fiscal and economic policies. The study's conclusions contribute to a deeper understanding of the macroeconomic dynamics at play in Pakistan's economic landscape, offering implications for policy formulation and decision-making aimed at promoting sustainable growth and development.

Lahoti and Swaminathan (2013) conducted an empirical investigation into the relationship between economic growth and female labor force participation in India, spanning from 1983 to 2010. Employing robust econometric techniques, the study aimed to assess the dynamics of female employment in response to changes in key economic indicators. The findings of the study revealed significant insights into the determinants of female labor force participation in the Indian context. Specifically, the analysis identified a significant positive effect of growth in agricultural employment share on female employment. This suggests that increases in the share of agricultural employment within the economy tend to correspond with higher levels of female labor force participation. However, the study found that growth in agricultural value share did not exhibit a significant effect on female employment. This divergence in results between value shares and employment shares may be attributed to the relatively low level of correlation between value added and employment generation in the agricultural sector. It is plausible that while agricultural value added may increase, the corresponding impact on female employment may not be as pronounced due to various factors influencing labor demand and allocation within the sector.

Mujahid and Naem Uz Zafar (2012) conducted an empirical study to examine the nexus between economic growth and female labor force participation in Pakistan over the period from 1980 to 2010. Employing a range of econometric techniques including ADF Unit Root Test, Phillips and Perron Unit Root Test, and Zivot-Andrews Unit Root Test, as well as the ARDL Bounds Testing Approach to Co-integration, the study aimed to uncover the dynamics of female labor force participation in response to economic growth. The findings of the study revealed a robust link between economic growth and female labor supply in Pakistan. This underscores the importance of economic development in driving increased participation of women in the labor force. The study suggests that policymakers should prioritize initiatives aimed at enhancing female education and skills development to further augment female labor force participation rates. Additionally, the adoption of gender-specific wage laws may help to reduce the earnings gap between genders, thereby promoting greater gender equality in the labor market. Furthermore, the study highlights the significance of measures aimed at improving employment opportunities, particularly in the manufacturing and industrial sectors, as a means to bolster female labor supply. By expanding job opportunities and fostering a conducive environment for female employment, policymakers can effectively harness the potential of women as valuable contributors to the labor force and the overall economy.

Hossain (2012) conducted an analysis of the labor force and GDP relationship in Bangladesh spanning from the year 2000 to 2009. Employing econometric techniques such as Ordinary Least Squares (OLS) methods, the study aimed to explore the dynamics between the labor force participation and Gross Domestic Product (GDP) in Bangladesh. The findings of the study revealed a strong positive relationship between the labor force and GDP in Bangladesh during the specified period. This indicates that as the labor force expands or contracts, there is a corresponding movement in GDP, reflecting the influence of labor market dynamics on economic output. Furthermore, the study likely uncovered additional insights into the nature of this relationship, such as the magnitude of the impact of changes in the labor force on GDP, as well as potential feedback effects from GDP growth to labor force participation.

Novignon, Nonvignon, and Arthur (2015) investigated the relationship between health status and labor force participation in Sub-Saharan Africa (SSA) spanning from the year 1990 to 2011. Employing econometric techniques such as panel analysis, the study aimed to explore how population health status, as measured by life expectancy at birth, influences labor force participation in the region. The findings of the study revealed a positive and significant effect of population health status on both total and female labor force participation across countries in SSA. This suggests that as the health status of the population improves, there is a corresponding increase in labor force participation, holding other factors constant. This relationship underscores the importance of investing in healthcare and improving health outcomes as a means to enhance labor force participation and potentially boost economic productivity in SSA countries. By promoting better health among the population, policymakers may be able to stimulate greater engagement in the labor market, thereby contributing to overall economic development and poverty reduction efforts in the region.

Lechman (2014) conducted an analysis on the relationship between female labor force participation and economic growth, specifically re-examining the hypothesis of a U-shaped curve from the year 1990 to 2012. Employing econometric techniques such as Generalized Method of Moments (GMM) and panel data analysis, the study aimed to investigate the nature of this relationship. The findings of the study indicated mixed results regarding the hypothesized U-shaped relationship between female labor force participation and economic growth. While the hypothesis was examined, the study also noted significant cross-country variability in this field. This suggests that while there may be a general trend or pattern observed in some contexts regarding the relationship between female labor force participation and economic growth, there are considerable differences across countries that need to be taken into account. Further research and analysis may be needed to understand

the specific factors driving these variations and their implications for policy interventions aimed at promoting female labor force participation and fostering economic growth.

Lechman and Kaur (2015) conducted an analysis on the relationship between economic growth and female labor force participation, specifically verifying the U-Feminization Hypothesis from the year 1990 to 2012. Using econometric techniques such as pooled Ordinary Least Squares (OLS) method, they aimed to determine the nature of this relationship. The study found support for the U-hypothesis, suggesting that in the early stages of economic growth, female labor force participation tends to decline. However, as a country progresses in economic development and its economy shifts towards being more service-based, female labor force participation systematically increases. Despite empirically confirming the U-shaped relationship, the study noted considerable cross-country variability in this field. Upon disaggregating the evidence and examining similar relationships between female labor force participation and GDP per capita across four distinct income groups, variations were observed. Particularly, in high-income and upper-middle-income economies, the existence of the U-shaped relationship was positively verified, although it disappeared when dynamic effects were introduced. These findings highlight the complex dynamics underlying the relationship between economic growth and female labor force participation, suggesting that contextual factors and economic development stages play significant roles. Further research may be necessary to explore these relationships in greater depth and understand their implications for policy interventions aimed at promoting gender equality and economic development.

Qadri and Waheed (2011) conducted an analysis on the relationship between human capital and economic growth in Pakistan, recognizing human capital as a positive contributor to economic development. They explored this relationship using time series data from the period 1978 to 2000. Employing a health-adjusted education indicator of human capital within the recognized Cobb-Douglas production function, the study confirmed a long-run positive relationship between human capital and economic growth in Pakistan. These findings align broadly with results from various studies indicating that employment and labor force also have significant effects on economic growth. The study underscores the importance of investing in human capital, particularly in education and health, as a means to foster economic development in Pakistan. By enhancing the skills, knowledge, and health of the workforce, policymakers can promote sustainable growth and prosperity in the country.

Kakar, Khilji, and Jawad (2011) conducted an analysis on the relationship between education and economic growth in Pakistan, focusing on the period from 1980 to 2009. They utilized econometric techniques such as co-integration and error correction models to examine both the long-run and short-run dynamics between education and economic growth. Their findings suggest that education exhibits a long-run relationship with economic growth in Pakistan. They observed that higher standards of education contribute to enhanced efficiency and productivity of the labor force, ultimately impacting economic development positively over the long term. However, the study also revealed that in the short run, education does not exhibit any significant relationship with economic growth. This implies that while investments in education may not yield immediate economic benefits, they are crucial for fostering sustainable growth and development in the long run. Therefore, policymakers should prioritize initiatives aimed at improving the quality and accessibility of education to support Pakistan's economic progress over time.

Nawaz (2014) conducted an analysis to identify the factors influencing the economic growth of Pakistan, focusing on the period from 1998 to 2012. The study employed econometric techniques such as co-integration, vector error correction model (VCM), and Granger causality tests to investigate these relationships. The study's results revealed that the findings cannot be generalized to non-banking industries in Pakistan or other developing countries due to various reasons. Instead, the results are applicable primarily to the banking sector in Pakistan and in developing countries with similar banking cultures and environments. This implies that the factors influencing economic growth in Pakistan, as identified in the study, may be specific to the banking sector and may not necessarily apply to other industries or economies. Therefore, policymakers and researchers should consider these limitations when interpreting and applying the findings of the study to broader economic contexts.

Afzal, Farooq, Ahmad, Begum, and Quddus (2010) conducted a study to examine the relationship between school education and economic growth in Pakistan spanning from 1970 to 2009. The study employed econometric techniques such as the autoregressive distributed lag (ARDL) approach to co-integration, as well as unit root tests including the augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Ng-Perron tests. Their findings revealed several significant relationships. Firstly, they found that physical capital had a positive and significant effect on economic growth, as supported by both long-run and short-run dynamic models. Secondly, they observed a significant direct effect of the net school enrollment ratio on economic growth, evident in both the short-run and long-run analyses. Furthermore, the study highlighted the impact of inflation, a measure of macroeconomic instability, on economic growth. They found that inflation negatively affected economic growth in both the short-run and long-run analyses. Additionally, inflation was found to have a significant negative impact on school education, but only in the long-run. These results suggest the importance of investing in physical capital and promoting school education to foster economic growth in Pakistan. Moreover, policymakers should address inflation to mitigate its adverse effects on both economic growth and educational outcomes in the long run.

Wilson and Briscoe (2004) conducted a study to assess the impact of human capital on economic growth, particularly focusing on the effects of education and training. Their research, titled "Impact of Education and Training," constituted the Third Report on Vocational Training Research in Europe. In their study, Wilson and Briscoe provided a comprehensive and critical overview of how education and training influence economic performance and, consequently, employment opportunities at the macro level. They employed panel root and integration methods to analyze their data. Their findings indicated that an increase

in health expenditures or investments led to a subsequent increase in economic growth. This suggests that investments in health contribute positively to overall economic development. By highlighting the importance of health expenditures in stimulating economic growth, their study underscores the significance of investing in healthcare as a means to promote economic prosperity. In their study titled "Economic Growth and Human Development," Ranis, Stewart, and Ramirez (2000) aimed to analyze the relationship between economic growth and human development. They identified two chains linking these two concepts: one chain leading from economic growth to human development, and the other chain leading from human development to economic growth. The researchers explored various links within each chain and reviewed existing empirical evidence regarding their importance. They utilized cross-country statistics spanning the period from 1970 to 1992 to examine the significance of these relationships. Their findings revealed a strong positive relationship in both directions: from economic growth to human development and vice versa. They identified specific factors as particularly important links in these chains. Public expenditure on social services and female education were highlighted as crucial determinants of the relationship between economic growth and human development. Additionally, they found that the investment rate and income distribution played significant roles in determining the strength of the relationship between human development and economic growth.

3. RESEARCH METHODOLOGY AND MODEL

Research methodology plays a crucial role in guiding the research process by providing a framework for identifying research areas, selecting appropriate approaches and methods, and systematically planning the study. It serves as a roadmap for researchers to ensure that their inquiries are academically rigorous, practically feasible, and realistic. One of the key decisions in research methodology is choosing between quantitative and qualitative approaches, which depends on the aim of the inquiry and the intended use of the findings. The current study adopts a quantitative research methodology, aiming to quantify economic relationships among variables. This approach is chosen to develop a deeper understanding of the relationship between economic growth and human capital. The study utilizes panel estimation techniques, leveraging observations of multiple variables over time and across different entities.

Human capital, a key focus of the study, is measured using various proxies commonly employed in the literature, including investment, net secondary school enrollment, health expenditures, total labor force, and life expectancy at birth. These proxies serve as indicators of the quality and quantity of human capital within a given population. Additionally, the study incorporates other relevant variables, such as inflation, to capture economic dynamics and organizational quality. By including inflation in the model, the study aims to assess its impact on economic plans and overall institutional performance. In short, the quantitative approach and panel estimation methodology enable the study to systematically analyze the relationship between economic growth and human capital, shedding light on important factors influencing economic development. $gdp_{it} = \beta_0 + \beta_1 inf_{it} + \beta_2 inv_{it} + \beta_3 educ_{it} + \beta_4 hexp_{it} + \beta_5 tlb_{it} + \beta_6 leb_{it} + u_{it}$ (1)

Where;

- gdp_{it} = Gross domestic product
- inf_{it} = Inflation
- inv_{it} = Investment
- $educ_{it}$ = Net secondary school enrollment
- $hexp_{it}$ = Health expenditures
- tlb_{it} = Total labor force
- leb_{it} = Life expectancy at birth
- β = constants (intercepts and slope)
- u_{it} = error term
- it = i for cross section and t for time period

Economic Growth (GDP) is assessed in real US dollars, reflecting the overall value of goods and services produced within the economy over a specific period, with adjustments made for inflation. This metric serves as a key indicator of the economy's performance and its trajectory over time. Inflation is measured in annual percentage terms, depicting the rate at which the general price level of goods and services is increasing over time. This metric provides insight into changes in purchasing power and the overall stability of prices within the economy. Investment is evaluated based on gross capital formation in real US dollars, encompassing the total value of investments made in fixed assets by both the public and private sectors. This metric highlights the level of capital accumulation and its contribution to economic development. Net Secondary School Enrollment is expressed as a percentage, representing the proportion of secondary school-aged children enrolled in secondary education programs. This metric offers insight into educational accessibility and attainment levels within the population. Health Expenditures are quantified by health expenditure per capita in real US dollars, reflecting the total amount of money allocated to healthcare per individual within the population, adjusted for inflation. This metric assesses the adequacy of healthcare funding and its impact on public health outcomes. Total Labor Force is measured in numbers, representing the total count of individuals who are either employed or actively seeking employment within the economy. This metric provides a snapshot of the labor market dynamics and workforce participation rates. Life Expectancy at Birth is determined in total years, indicating the average number of years a newborn can expect to live under prevailing mortality conditions. This metric serves as a crucial indicator of overall population health and well-being. These measurement methodologies offer standardized

criteria for assessing and analyzing the relationships between key variables in the study, facilitating robust quantitative analysis and interpretation of findings.

4. ESTIMATIONS

The descriptive statistics provided in Table 1 offer insights into the distribution and characteristics of various variables under study. The variables considered include GDP_{11,23} (Gross Domestic Product), INF_{11,23} (Inflation), INV_{11,23} (Investment), EDU_{11,23} (Education expenditure), HEXP_{11,23} (Health expenditure), TLF_{11,23} (Total Labor Force), and LEB_{11,23} (Life Expectancy at Birth). Across the variables, the mean values provide a measure of central tendency, indicating the average level of each variable over the specified time period (presumably from 2011 to 2023). For instance, the mean GDP_{11,23} is approximately 10.8942, reflecting the average GDP level during this period. The median values, which represent the middle observation in the dataset when arranged in ascending order, offer an alternative measure of central tendency. They provide insight into the distribution's central tendency while being less influenced by extreme values compared to the mean. For example, the median INF_{11,23} is approximately 6.7643, indicating the middle value of inflation observations. The maximum and minimum values highlight the range within which each variable varies. They denote the highest and lowest observed values, respectively, during the specified period. For instance, the maximum value of GDP_{11,23} is 11.9155, while the minimum is 8.64262. Standard deviation measures the dispersion or variability of data points around the mean, providing insight into the data's spread. Variables with higher standard deviations exhibit greater variability from the mean. For example, INF_{11,23} has a relatively high standard deviation of approximately 12.7131, indicating considerable variability in inflation over the period. Skewness measures the asymmetry of the distribution. A skewness value of zero indicates a perfectly symmetrical distribution, while positive skewness suggests a longer tail on the right side of the distribution and vice versa. For instance, the variable INF_{11,23} exhibits positive skewness, indicating a right-skewed distribution. Kurtosis quantifies the "tailedness" of the distribution. High kurtosis values indicate heavy tails or outliers in the distribution, while low kurtosis values suggest light tails. For example, the variable INF_{11,23} exhibits relatively high kurtosis, indicating heavy tails in the distribution of inflation. The Jarque-Bera statistic tests the null hypothesis that the data follow a normal distribution based on skewness and kurtosis. A significant Jarque-Bera statistic (with a low probability) indicates non-normality in the data distribution. For instance, variables like INF_{11,23} and TLF_{11,23} exhibit significant departures from normality, as indicated by the low probabilities associated with their Jarque-Bera statistics.

Table 1: Descriptive Statistics

Description	GDP _{11,23}	INF _{11,23}	INV _{11,23}	EDU _{11,23}	HEXP _{11,23}	TLF _{11,23}	LEB _{11,23}
Mean	10.8942	10.5873	10.2488	62.8843	161.7287	7.2009	69.7957
Median	11.1093	6.7643	10.3963	65.9953	114.3993	7.3642	69.4153
Maximum	11.9155	81.4548	11.1428	90.9337	628.5030	7.8798	75.1759
Minimum	8.64262	-5.9922	8.4399	22.3701	8.5461	5.3493	60.2908
Std. Dev.	0.7757	12.7131	0.6615	18.3433	158.7939	0.6555	3.5184
Skewness	-1.3904	3.2069	-1.2977	-0.2846	1.3643	-1.7374	-0.2455
Kurtosis	4.3642	15.1366	4.1104	1.9206	4.1711	5.2318	2.2147
Jarque-Bera	36.3797	714.4870	30.2168	5.6464	33.4317	64.6726	3.2523
Probability	0.0000	0.0000	0.0000	0.0594	0.0000	0.0000	0.0966

The panel ADF unit root test statistic presented in Table 2 assesses the stationarity of various variables under consideration. The variables include GDP_{11,23} (Gross Domestic Product), INF_{11,23} (Inflation), INV_{11,23} (Investment), EDU_{11,23} (Education expenditure), HEXP_{11,23} (Health expenditure), TLF_{11,23} (Total Labor Force), and LEB_{11,23} (Life Expectancy at Birth). For each variable, the table provides test statistics for both the level (I(0)) and first-difference (I(1)) specifications, with considerations for different specifications such as trend and intercept and lag length. Under the "Level I(0)" column, the test statistics represent the unit root test results for the variables at their original level without differencing. For instance, the GDP_{11,23} variable has a test statistic of 21.4694, indicating the presence of a unit root at the 10% significance level when considering both trend and intercept with a lag length of 3. In contrast, under the "Level (1)" column, the test statistics represent the unit root test results for the variables after taking the first difference. This process helps in transforming non-stationary series into stationary ones. For example, the INF_{11,23} variable has a test statistic of 66.0795, indicating stationarity at the 10% significance level when considering both trend and intercept with a lag length of 4. The asterisk (*) next to certain test statistics denotes Fisher Chi-square critical values for rejecting the null hypothesis of a unit root, with significance at the 10% level. This indicates the level of confidence at which the null hypothesis of a unit root is rejected.

Table 2: Unit Root Test

Variables	Level I(0)		Level (1)	
	Trend and Intercept	Lag length	Trend and Intercept	Lag length
GDP _{11,23}	21.4694	3	66.0795*	4
INF _{11,23}	79.7604*	4	NA	NA
INV _{11,23}	30.2225	2	100.519*	4
EDU _{11,23}	9.96033	1	27.5513*	1
HEXP _{11,23}	17.9586	3	69.1978*	3
TLF _{11,23}	32.3732	4	59.8861*	3
LEB _{11,23}	21.6875	4	83.7002*	4

Table 3 presents the results of a Pooled Ordinary Least Squares (OLS) regression analysis with GDP_{11,23} (Gross Domestic Product) as the dependent variable. The model aims to explore the relationship between GDP_{11,23} and several explanatory variables including INF_{11,23} (Inflation), TLF_{11,23} (Total Labor Force), EDU_{11,23} (Education expenditure), LEB_{11,23} (Life Expectancy at Birth), HEXP_{11,23} (Health expenditure), and INV_{11,23} (Investment). The regression coefficients indicate the estimated impact of each explanatory variable on GDP_{11,23}, holding other variables constant. The intercept coefficient is estimated to be -0.568628, but it is not statistically significant at the 10% level.

Table 3: Pooled OLS

Dependent Variable: GDP _{11,23}					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	
Intercept	-0.568628	0.362433	-1.568919	0.1204	
INF _{11,23}	-0.002560	0.001250	2.047861	0.0437	
TLF _{11,23}	0.457925	0.052241	8.765565	0.0000	
EDU _{11,23}	0.002037	0.000992	-2.054366	0.0430	
LEB _{11,23}	0.032437	0.008542	3.797340	0.0003	
HEXP _{11,23}	0.001009	0.000136	7.391687	0.0000	
INV _{11,23}	0.569742	0.073817	7.718276	0.0000	
R-squared	0.979312	F-statistic		662.7199	
Adjusted R-squared	0.977834	Prob(F-statistic)		0.000000	

The coefficient for inflation (INF_{11,23}) is estimated at -0.002560, suggesting that an increase in inflation is associated with a decrease in GDP_{11,23}. This coefficient is statistically significant at the 5% level, indicating its importance in explaining variations in GDP_{11,23}. TLF_{11,23} (Total Labor Force) shows a positive coefficient of 0.457925, implying that an increase in the total labor force is associated with an increase in GDP_{11,23}. This coefficient is highly statistically significant, underlining the significant impact of labor force on GDP. However, the coefficient for education expenditure (EDU_{11,23}) is not statistically significant at the 10% level. On the other hand, variables related to public health and investment exhibit notable impacts on GDP_{11,23}. Both LEB_{11,23} (Life Expectancy at Birth) and HEXP_{11,23} (Health expenditure) have positive coefficients of 0.032437 and 0.001009, respectively, indicating that higher life expectancy and health expenditure positively influence GDP_{11,23}. These coefficients are highly statistically significant. Similarly, INV_{11,23} (Investment) demonstrates a strong positive relationship with GDP_{11,23}, with a coefficient of 0.569742. This suggests that an increase in investment leads to a corresponding increase in GDP_{11,23}, and the coefficient is statistically significant at a high level. Overall, the regression model has an R-squared value of 0.979312, indicating that approximately 97.93% of the variance in GDP_{11,23} is explained by the model. The F-statistic of 662.7199 is highly significant, underscoring the overall significance of the regression model in explaining variations in GDP_{11,23}. Moreover, the adjusted R-squared value of 0.977834 further confirms the goodness of fit of the model.

5. CONCLUSIONS

This study investigates the relationship between human capital and economic growth across eleven diverse countries, including Bangladesh, Bhutan, China, India, Malaysia, Nepal, Pakistan, Sri Lanka, Thailand, Turkey, and Ukraine. Using a panel data approach, the study examines various indicators of human capital, such as investment, education, health expenditure, total labor force, and life expectancy, over a specified time period. The aim is to uncover patterns and relationships that illuminate the interplay between human capital development and economic growth, providing insights crucial for policymakers and stakeholders. Human capital's role in shaping economic outcomes is particularly significant for developing countries, where resource allocation towards human capital development is integral to sustainable progress. Previous research has employed diverse methodological approaches, including linear and nonlinear models, and single-

country and panel data analyses, to explore this relationship. In this study, panel data analysis is the primary methodological framework, focusing specifically on Pakistan. Econometric tools are used to analyze data collected over time, including explanatory variables such as inflation, investment, education, health expenditure, total labor force, and life expectancy. The study aims to provide robust empirical evidence on the relationship between human capital and economic growth in Pakistan. The analysis covers the period from 1992 to 2016, allowing for examination of long-term trends. Descriptive statistics reveal non-normal distributions, and the panel Augmented Dickey-Fuller (ADF) Unit Root test confirms stationarity of the variables. Pooled Ordinary Least Squares (OLS) regression indicates a long-run relationship among the variables, with human capital exerting a statistically significant influence on economic growth at the 1% level. Overall, the findings highlight the importance of investing in education, health, and other forms of human capital to foster sustainable economic development and prosperity.

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