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Human Capital as a Driving Force for Economic Growth in GCC Countries: Pooled Mean Group Estimation

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Abstract

This study explored the relationship between human capital metrics and economic growth in the Gulf Cooperation Council (GCC) countries from 2000 to 2022. This research utilized a pooled mean group-autoregressive distributed lag approach to empirically assess the influence of selected macroeconomic factors—specifically human capital, gross capital formation, government expenditure on health and education, and foreign direct investment (FDI)—on gross domestic product. The results indicated that, in the short term, all human capital indicators positively impacted economic growth, except for FDI. Conversely, in the long term, all variables' impact was positive and significant. School enrollment, governmental spending on education and health, FDI, employment, and capital formation positively influenced long-term economic growth. Governments must develop workforce skills in education, health, and productive sectors to enhance economic growth in GCC countries. Implementing robust structural reforms is essential, focusing on manufacturing sector development, economic diversification, reducing oil dependency, and boosting productivity and innovation in research and technology.

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Introduction

Numerous macroeconomic factors influence economic growth, including employment, government expenditure, capital formation, inflation, and investment. This study focused on a subset of these variables—government spending on health and education, physical and human capital, and investment—identified as having the most significant impact on economic growth in developing economies (Bashir, 2024; Borrescio-Higa & Valenzuela, 2021; Chen et al., 2022; Tackie et al., 2022). Employment, alongside human and physical capital, is recognized as the most crucial factor of production. Investment in human capital enhances employment efficacy and is frequently linked to economic growth acceleration (Hussain & Das, 2023).

The six Gulf Cooperation Council (GCC) countries are characterized by rapid development among developing nations and possess adequate educational and health facilities. Investments in the health sector have yielded significant returns, as evidenced by increased life expectancy. Additionally, education has boosted the employment-to-population ratio. Over the past two decades, the GCC countries have achieved notable advancements in human development, with significant improvements in the education and health sectors (World Bank, 2019). Figs. 1 and 2 illustrate a substantial increase in government expenditure on education and health in the GCC countries from 2000 to 2022.

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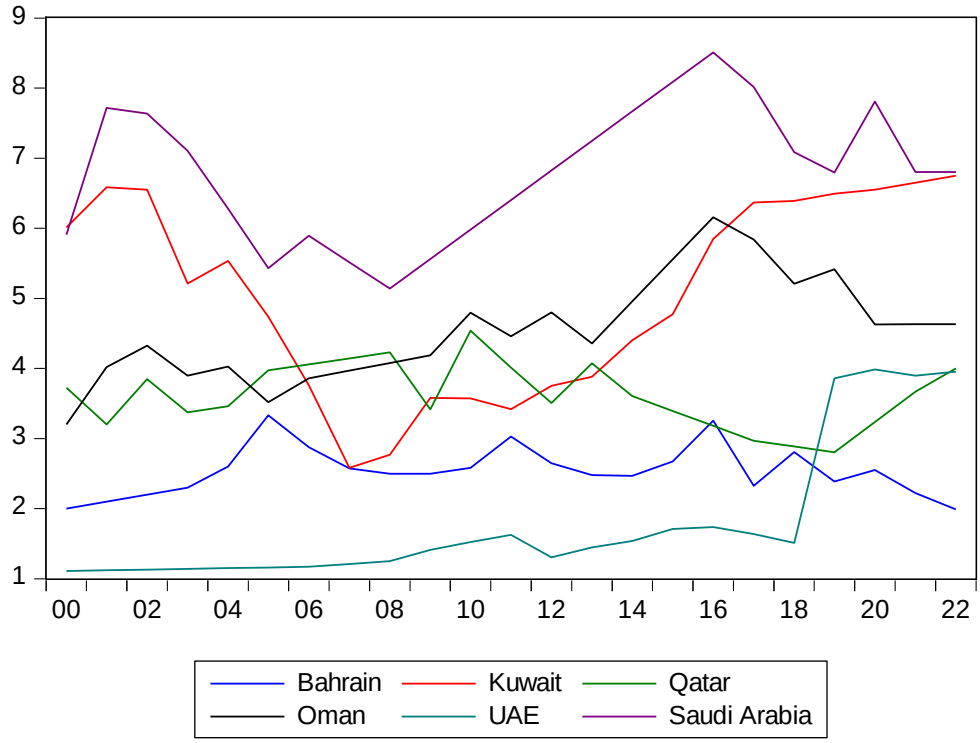

Fig. 1. Government Expenditure on Education, 2000–2022

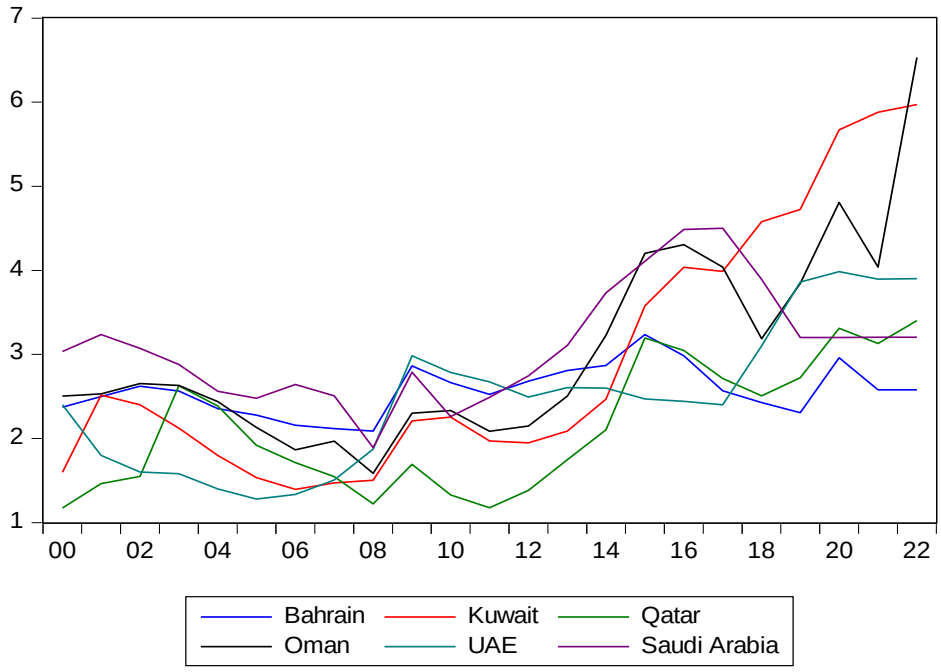

Fig. 2. Government Expenditure on Health, 2000-2022

The role of human capital in fostering economic growth is widely recognized and documented across various economic schools of thought (Wirajing et al., 2023; Adeleye et al., 2022). Critical theorists such as Lucas (1988), Romer (1990), Mankiw, Romer, and Weil (1992), and Barro and Sala-I-Martin (1997) highlighted that enhancing labor productivity, encouraging technological innovation and adaptation, and reducing fertility rates are pivotal ways through which the accumulation of human capital—via

education and on-the-job training—promotes economic growth.

Additionally, education cultivates innovative thinking and contributes to the advancement of scientific knowledge. Investments in health and education bolster human capital, enhancing physical capital and driving economic growth. The continued accumulation of knowledge significantly boosts individuals' productivity and efficiency. Research indicates experiential learning, or "learning by doing," leads to greater labor productivity and economic development.

This research study attempts to determine the short- and long-term effects of selected macroeconomic indicators—specifically human capital, gross capital formation, government expenditures on education and health, and foreign direct investment (FDI)—on economic growth within a panel of GCC countries. It contributes to the existing literature by examining the link between human capital variables and economic growth. Additionally, the study investigates how government spending on education and health fosters human capital development and how this human capital impacts economic growth. This research was designed to inform policymakers about enhancing resource allocation to these sectors. It adds value to the literature by analyzing the effects of human capital on economic growth, using the most recent panel data from GCC countries and pooled mean group-autoregressive distributed lag (PMG-ARDL) estimation techniques.

The remainder of this paper is structured as follows: Section two reviews the relevant literature, section three describes the methodology employed in the study; and section four discusses the interpretation and analysis of the results. Section five summarizes the key findings and offers policy recommendations.

2. Review of Related Literature and Theoretical Considerations

Various theories of economic growth start with different assumptions about the origins of economic development. While some theories posit that the accumulation of human capital is the primary driver of growth, others consider the stock of human capital as a crucial factor. Certain studies analyze both variables. However, all theories recognize that human capital contributes significantly, either directly or indirectly, to economic growth. More recent theories have developed models that address human capital externalities—such as technological diffusion, innovations, fertility rates, young adult mortality, and infant mortality (Geng, 2022).

Endogenous growth theory asserts that investments in human capital, knowledge, and innovation contribute substantially to economic growth (Barkhordari et al., 2019; Osiobe, 2019; Yeo & Lee, 2020). It highlights human capital stock as the most significant determinant of economic growth. The study of economic growth extensively explores the impact of human capital on economic expansion (Altiner & Toktaş, 2017). Additionally, modern economic theory posits that economic growth is driven by technological change, the accumulation of individual skills, and the incentives that govern economic decisions, including acquiring physical and human capital. Human capital stocks are considered crucial production factors, enhancing efficiency and productivity and increasing the rate of inventions in enterprises and the broader economy (Mohamed et al., 2021; Simeonova-Ganeva, 2010).

Numerous studies using analytical models based on cross-sectional or panel data have revealed a strong correlation between human capital and economic growth. However, these studies have yielded mixed findings regarding the relationship between human capital and other economic growth factors. The results on the interaction between human capital metrics and other economic growth influencers vary across studies.

Between 2000 and 2017, Mabrouk and Abdulrahim (2021) investigated the relationship between productivity, human capital, and economic growth in GCC countries. Their study examined how human capital and productivity development contribute to enhanced economic growth. They found that both human capital and productivity significantly and positively affect economic growth in the GCC region. Notably, the impact and significance of human development were more pronounced when time and country-specific dummy variables were incorporated. They also identified a positive correlation between selected economic indicators and Gross domestic product (GDP) per capita in the GCC

countries, primarily attributed to policies aimed at improving education. Economic diversification and political reforms were also found to stimulate economic growth further.

Hamdan et al. (2021) examined the role of human capital in the economic development of GCC countries from 1990 to 2019, utilizing a panel data approach. They implemented three models: the pooled regression model, the fixed-effects model (FEM), and the random-effects model (REM). Their findings are significant, with the REM emerging as the most effective model. This model demonstrated a direct and positive relationship between human capital and economic growth in the GCC countries.

Alhedadd et al. (2021) employed the FEM, REM, instrumental variables, and limited information maximum likelihood estimates to analyze the impact of FDI on economic growth in GCC countries. The results indicated that while non-resource FDI has minimal effects on growth, FDI inflows generally hinder economic expansion in these nations. Specifically, the study found that the overall inflow of greenfield FDI negatively affects economic growth, illustrating a crowding-out effect from resource-based FDI. These findings suggest that policymakers should develop a comprehensive strategy regarding direct FDI inflows to foster growth and achieve sustainable economic development.

Adeleye et al. (2022) conducted an empirical study on selected Middle East and North Africa (MENA) economies from 1980 to 2020, using education enrollment and life expectancy as proxies for human capital. The findings revealed that primary education is the most critical educational indicator, while life expectancy emerged as the most influential and significant indicator of human capital. These results highlight the importance of these indicators and confirm that neither education nor health can perfectly substitute for other human capital indicators.

Almutairi et al. (2023) explored human capital's impact on Saudi Arabia's economic development from 1990 to 2019. Utilizing an ARDL model and three educational human capital metrics, the study identified a negative correlation between the ratio of tertiary education enrollment, scholarships, and economic growth. However, the effect of average school years on growth was minimal and negative. Interestingly, oil wealth positively influenced economic progress, reflecting its impact on human capital investment. Despite substantial education spending by the Saudi government, the study also uncovered a negative correlation between oil wealth and economic growth, likely due to the Dutch disease and a reduced demand for an educated workforce. The findings underscore the dual influence of natural resource availability on human capital and economic growth and the potential for a highly skilled workforce to drive economic development.

Bekele et al. (2024) examined the influence of human capital development on economic sustainability in 30 sub-Saharan African countries, utilizing a mean group model for the period from 2000 to 2020. The findings revealed that human capital has negative impacts on economic sustainability. Consequently, the study suggests that these countries and their policymakers should reconsider the overall framework of human capital development, emphasizing quality education over mere access to education, as a policy alternative to achieve economic sustainability goals.

A variety of analytical models have been employed in numerous studies to explore the relationship between economic growth and human capital, utilizing cross-sectional and panel datasets (Adeleye et al., 2022; Almutairi et al., 2023; Bashir, 2024; Bekele et al., 2024; Dankyi et al., 2022; Dinh & Phuc Nguyen, 2022; Elamin, 2024; Elheddad et al., 2022; Hamdan et al., 2021; Rahman & Alam, 2021; Rahman et al., 2019; Bokhari, 2017). The outcomes of these studies on the link between human capital and macroeconomic growth variables have been inconsistent. While these studies aimed to identify determinants of growth, their findings were often inconclusive. This lack of reliability may stem from country heterogeneity, varied methodological approaches, differences in data timeframes, and potential misselection of relevant variables.

Building on the discussion of relevant literature, it is evident that human capital is widely acknowledged as a fundamental driver of economic growth. However, the specific impact of human capital on economic development in GCC countries remains underexplored. To our knowledge, no existing studies have simultaneously utilized various approximations

of human capital and the panel ARDL approach. Therefore, this paper examined both the short-run and long-run effects of human capital variables on economic growth in GCC countries from 2000 to 2022. This analysis employed the PMG-ARDL, a sophisticated econometric technique, within the framework of the Cobb-Douglas production function for a panel of GCC countries. Proponents of endogenous growth theory contend that human capital is crucial in fostering economic growth, as developing human capital leads to an increase in innovative entrepreneurs and productivity, ultimately driving economic expansion (Alataş & Çakır, 2016; Diebolt & Hippe, 2019).

No prior research in the GCC countries has integrated variables such as life expectancy at birth, public spending on health, education, and student enrollment into a single model to assess the influence of human capital on economic growth. This research gap for the period between 2000 and 2022 was addressed in the current study. Unlike previous research, the scientific novelty of this study lies in considering FDI as a determinant due to its role in economic growth through technology transfer and backward and forward linkages. Additionally, this study underscores the significance of human capital characteristics as crucial contributors to economic growth. This research could also offer valuable policy implications to stimulate economic growth in GCC countries through enhanced human capital development.

3. Methodology and Data Source

3. 1 Model Specification

A model was developed based on endogenous growth theory to explore the relationship between economic growth and human capital-related variables in the six GCC countries. The functional relationship is defined as follows (Bashir, 2024):

$$GDP = f\ (EM, SE, FDI, CF, EB, GEX, GHE) \quad (1)$$

The equation identifies GDP, representing economic growth, as the dependent variable, while EM, indicating employment level, serves as an independent variable. SE symbolizes school enrollment, and FDI denotes foreign direct investment. CF represents capital formation, EB stands for life expectancy at birth, GEX stands for government spending on education, and GHE stands for government spending on health. To address potential heteroscedasticity, the values of these variables are transformed into natural logarithms. The empirical equation can be expressed as follows:

$$LGDP_{it} = \alpha_0 + \gamma_1 LEM_{it} + \gamma_2 LSE_{it} + \gamma_3 LFDI_{it} + \gamma_4 LCF_{it} + \gamma_5 LEB_{it} + \gamma_6 LGEX_{it} + \gamma_7 LGHE_{it} + \varepsilon_{it} \quad (2)$$

In this model, LGDP, LEM, LSE, LFDI, LCF, LEB, LGEX, and LGHE represent the natural logarithms of economic growth, employment, school enrollment, foreign direct investment, capital formation, life expectancy at birth, government spending on education, and government spending on health, respectively. The variable *t* represents the period (2000–2022), and *i* refers to the six GCC countries. The term and α_0 is a constant, $\gamma_1\ to\ \gamma_7$ are the coefficients of the respective variables, and ε_{it} is the error term in the model.

When applied to panel datasets, the PMG-ARDL approach addresses the limitations inherent in the ARDL estimation method, particularly its inability to account for bias resulting from correlations between the white noise term and the mean differenced independent variables. This method integrates the ARDL model with the PMG estimator, a combination proposed by Sarkodie and Strezov (2018) and initially developed by Pesaran et al. (1999). The PMG-ARDL model adapts the cointegration framework of the simple ARDL model for panel data analysis by allowing for variations in intercepts, short-run coefficients, and cointegrating terms across different cross-sections. Consequently, the model can be articulated using the following equation:

$$\Delta y_{it} = \beta + \delta y_{it-1} + \varphi_0 \sum_{i=1}^{p} \Delta y_{it-1} + \varphi_1 \sum_{i=1}^{p} \Delta LEM_{it-1} + \varphi_2 \sum_{i=1}^{p} \Delta LSE_{it-1} + \varphi_3 \sum_{i=1}^{p} \Delta LFDI_{it-1} + \varphi_4 \sum_{i=1}^{p} \Delta LCF_{it-1} + \varphi_5 \sum_{i=1}^{p} \Delta LEB_{it-1} + \varphi_6 \sum_{i=1}^{p} \Delta LGEX_{it-1} + \varphi_7 \sum_{i=1}^{p} \Delta LGHE_{it-1} + \gamma_0 y_{it-1} + \gamma_1 LEM_{it-1} + \gamma_2 LSE_{it-1} + \gamma_3 LFDI_{it-1} + \gamma_4 LCF_{it-1} + \gamma_5 LEB_{it-1} + \gamma_6 LGEX_{it-1} + \gamma_7 LGHE_{it-1} + \aleph_i + \varepsilon_{it} \quad (3)$$

In the model, δ represents the coefficient of the past lagged values of the dependent variable. φ_1 to φ_7 are the short-term coefficients, and γ_0 to γ_7 denote the long-term coefficients. The PMG-ARDL model, employing the PMG estimator developed by Pesaran et al. (1999), incorporates an error-correction mechanism computed via a maximum likelihood procedure. This method effectively captures short-term dynamics and long-term equilibrium relationships within panel data settings (Bashir, 2024; Ciarlone, 2019).

3.2 Definition of the Variables

This study empirically investigated the impact of seven explanatory variables—employment (EMP), foreign direct investment (FDI), school enrollment (SE), capital formation (CF), government expenditure on education (GEX), government health expenditure (GHE), and life expectancy at birth (LEB)—on the GDP of the six GCC countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) over the period from 2000 to 2022. Table 1 presents the measurement units for these variables. The annual data for the selected variables were sourced from the World Development Indicators (World Bank, 2024).

Table 1. Measures of Variables

Variable	Unit of Measurement
Economic growth (GDP)	Real Gross Domestic Product (Constant Prices $)
Employment (EM)	Number of employed to population (%)
Foreign Direct Investment (FDI)	% of GDP
School enrolment (SE)	Number of pupils in Primary and secondary schools
Gross Capital Formation (CF)	% of GDP
Government Expenditure on Education (GEX)	% of GDP
Government Expenditure on Health (GHE)	% of GDP
Life Expectancy at Birth (LEB)	Number of years

4. Empirical Findings and Discussion

The initial stages of empirical analysis involved testing selected variables' integration order and stationarity. This study employed the ARDL-PMG estimator to assess the statistical characteristics of the sampled variables following its protocol.

4.1 Cross-sectional Dependence Test

Preliminary tests are essential before estimating unknown panel parameters. The Cross-sectional Dependence (CSD) and nonstationarity tests reveal crucial characteristics of the research variables. The Breusch-Pagan LM, Pesaran Scaled, and Pesaran CD tests, as shown in Table 2, were used for this purpose. The results from the Breusch-Pagan LM and Pesaran Scaled tests were statistically significant, rejecting the null hypothesis (H_0) of no CSD. These findings confirm that the data series from 2000 to 2022 exhibit CSD for the six GCC countries, suggesting that shocks in one GCC country likely spread to others due to integration and globalization.

Table 2. Cross-sectional Dependence Tests

CSD-Tests	Statistic	P-value
Breusch-Pagan LM	39.286	0.000***
Pesaran Scaled	4.434	0.000***
Pesaran-CD	-1.294	0.195

***Note:* *** indicates significance at the 1% level.**

4.2 Heterogeneity of the Slope Test

Following this assessment, we applied the revised slope homogeneity test proposed by Pesaran and Yamagata (2008), as shown in Table 3. This method evaluates the presence of heterogeneous slope coefficients, which can result in biased estimates (Alam et al., 2018). The empirical results of the slope homogeneity test reject the null hypothesis of no homogeneity.

Table 3. Result of Slope Heterogeneity

Test statistics	Value	P-value
Delta tilde (Δ)	6.287	0.000***
Adj. Delta tilde (Δ)	8.058	0.000***

***Note:* *** indicates significance at the 1% level.**

4.3 Panel Unit Root Test

Table 4 presents the results of second-generation nonstationarity tests, including cross-sectionally augmented IPS (CIPS) and cross-section covariate augmented Dickey-Fuller (CADF) panel unit root tests for level and first difference (Pesaran, 2007; Westerlund & Hosseinkouchack, 2016). These tests indicate that all variables—GDP, EM, FDI, SE, CF, GEX, LEB, and GHE—are differenced stationary, I(1), for the constant and first difference. The unit root test results show that the panel data for all variables are stationary at the first difference, permitting the use of PMG-ARDL in this empirical investigation. The cointegration test confirms a long-term equilibrium between the variables. Overall, the findings highlight the importance of both education and health measures of human capital and emphasize the need for policymakers to consider economic development levels when designing policies to enhance the impact of human capital on economic growth in GCC countries.

Table 4. CADF and CIPS Panel Unit Root Tests

Variables	CADF		CIPS	
	I(0)	I(1)	I(0)	I(1)
GDP	-2.519**	-2.822***	-1.981	-3.208***
EM	-1.936	-3.101***	-0.900	-2.679***
FDI	-2.937***	-3.173***	-2.676***	-4.951***
SE	-1.653	-2.801***	-1.847	-4.517***
CF	-1.883	-2.984***	-2.220*	-4.856**
GEX	-1.680	-2.836**	-2.004	-5.153***
LEB	-2.425**	-2.076	-2.762***	-4.818***
GHE	-2.079	-2.828***	-2.121*	-4.212***

***Notes:* (1) ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.**

(2) The critical values are obtained from Pesaran (2007). Therefore, the variables can be considered stationary if the absolute values of CADF and CIPS statistics are more significant than the critical values at the 1%, 5%, or 10% significance level.

4.4 Cointegration Test

To avoid spurious cointegration, this study utilized Westerlund bootstrap (Westerlund, 2007) panel cointegration tests, requiring four additional tests: Partial t (Pt), Partial a (Pa), Global t (Gt), and Global a (Ga). By minimizing CSD distortion, this method generates robust critical values. Table 5 indicates that persistent cointegration is validated among the variables, rejecting the null hypothesis of no cointegration, as the values of Gt and Pt statistics and their corresponding p-values are significant. Consequently, the second-generation cointegration test confirms a cointegrating relationship between the variables, establishing a long-term association.

Table 5. Westerlund Cointegration Test

Statistic	**Value**	***P*-value**	**Robust *P*-value**
Gt	-2.759	0.058**	0.008***
Ga	-3.384	0.999	0.655
Pt	-7.462	0.027**	0.070*
Pa	-4.273	0.915	0.428

***Note:* ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.**

4.5 Long-run and Short-run Analysis Based on PMG-ARDL

Table 6 presents a PMG-ARDL analysis, showing that GDP, EM, FDI, SE, CF, GEX, LEB, and GHE in the GCC countries of Bahrain, Kuwait, Qatar, Oman, United Arab Emirates, and Saudi Arabia from 2000 to 2022 are elastic. The results demonstrate strong cointegration among the GCC countries in the long and short run. The analysis found that employment levels positively impacted economic growth in the sampled countries.

Table 6. Results of the Short- and Long-run Estimates

Variables	**Coef.**	**Std. Error**	**T-test**	**Prob.**
Long-run estimates				
Dependent Variable: GDP				
EM	4.626	0.706	6.557	0.000***
FDI	0.004	0.002	2.003	0.092*
SE	1.361	0.146	9.310	0.000***
CF	0.520	0.125	3.417	0.001***
GEX	0.399	0.159	2.508	0.015**
LEB	2.334	0.938	2.488	0.016**
GHE	0.529	0.098	5.346	0.000***
Short-run estimates				
ECT (-1)	-0.088	0.032	-2.699	0.009***
EM	1.687	0.717	2.351	0.022**
FDI	0.002	0.003	1.306	0.214
SE	0.426	0.166	2.563	0.023**
CF	0.951	0.149	6.353	0.000***
GEX	0.545	0.216	2.518	0.025**
LEB	2.925	0.207	14.132	0.000***
GHE	0.078	0.038	2.045	0.042**
Heteroscedasticity				
Breusch–Pagan 1.449 0.265				
Breusch-Godfrey 0.342 0.717				

***Note:* ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.**

Specifically, a 1% increase in employment levels in GCC countries leads to an increase in economic growth of 4.63% and 1.69%, with statistical significance at 1% and 5%, respectively. An increase of 1% in FDI raises economic growth by 0.004% in the long run, which is statistically significant but causes a nonsignificant 0.002% increase in the short run. School enrollment levels in GCC countries have a positive and significant impact on economic growth, with a 1% increase in SE resulting in a 1.36% increase in the long run and a 0.43% increase in the short run, both statistically significant. Regarding CF, the findings show a positive and significant effect on economic growth in both the long and short runs. A 1% increase in CF boosts economic growth by 0.52% in the long run and 0.95% in the short run. The positive correlation between GEX and economic growth is evident in both the short and long runs, as reflected in Table 6. A 1% increase in GEX raises economic growth by 0.40% in the long run and 0.55% in the short run, both statistically significant. Consequently, the results indicate that LEB and GHE positively affect economic growth. The positive correlation between LEB and GHE suggests that economic growth in GCC countries also rises as these factors increase.

Concluding Remarks and Policy Implications

This research study examined the relationship between human capital variables and economic growth in GCC countries from 2000 to 2022. It analyzed these countries' public spending on education and health, employment, life expectancy, school enrollment, and FDI. The study incorporated heterogeneous panel causality tests, the panel ARDL method of the PMG estimator, cross-sectional dependence tests, cointegration tests, and additional diagnostic tests. It contributes to the existing literature on the interaction between human and physical capital variables and economic growth. The findings indicate that government spending on health and education enhances the effectiveness of human capital variables in promoting economic growth. Most statistically significant factors exhibit improved growth effects due to this interaction. These conclusions have important policy implications, emphasizing that countries aiming for faster economic growth should focus on building their human capital stocks in health and education. Investments in human and physical capital substantially contribute to GDP growth, and health spending and income play a vital role in increasing life expectancy in GCC countries. It demonstrates the effective use of government spending and resources allocated to these areas. Therefore, GCC countries must consistently allocate financial resources for human resource development to promote economic growth and social development.

In conclusion, this study's results have substantial practical implications for public policy to improve and support education and health, which are crucial for the future of GCC countries. The GCC nations must encourage fiscal restraint, economic diversification, and increased private-sector employment creation to achieve more sustainable growth. According to the World Bank (2019), GCC countries have steadily improved their competitiveness and attracted investors by enacting significant reforms such as facilitating business permits, reducing costs, allowing foreign ownership, and supporting women and young entrepreneurs. A comprehensive policy plan is needed to enhance the health and education sectors and boost human capital generation in GCC countries. Strategies to increase human capital include investing in early childhood development to provide a strong foundation for learning, preparing youth for the future by improving learning outcomes, aligning education with labor market needs, and reducing significant health risks like smoking, inactivity, and unhealthy diets.

Additionally, policies should aim to change social norms and behaviors, such as promoting lifelong learning, supporting female labor force participation, reducing skills mismatch, preventing chronic diseases and injuries, and lowering skill mismatches. Building and developing human capital, investing in training and development, and improving educational and research standards are necessary to strengthen economic growth. Future research should explore the impact of academic and health disparities on economic development in GCC countries. Individual countries should also investigate how human capital can impede long-term economic growth, such as

corruption, public official embezzlement, and capital flight.

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