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Interplay of Islam and Economic Growth: Unveiling the Long-run Dynamics in Muslim and Non-muslim Countries

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study delves into the intricate relationship between Islam and economic growth, examining how Islamic teachings impact economic policies and developmental outcomes. Using data from 47 countries over the period 2010-2021, and to achieve our research objectives the CS-ARDL estimating technique by Chudik et al. was employed. The research reveals that Islam positively influences economic growth in Muslim countries in the long run, with a less significant impact in non-Muslim countries. The study emphasizes the role of Islamic education in shaping the behavior

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of the Muslim population and its subsequent impact on economic growth. Recommendations include prioritizing investment in Islamic education to enhance human capital, fostering long-term economic plans that align with the positive influence of Islamic teachings, and leveraging education to contribute to sustained economic growth.

Keywords: Islam, economic growth; islamic education; muslim countries; CS-ARDL.

JEL Classifications: C33, O47, P47

1. INTRODUCTION

The intricate connection between Islam and economic growth within countries where Islam is the predominant religion has sparked extensive debates among economists and scholars. Determining whether Islam facilitates economic growth lacks a straightforward answer due to the complexity of factors involved, including historical, cultural, political, and institutional contexts [1,2,3].

Some scholars argue that certain principles and values within Islamic teachings, such as the emphasis on social justice, ethical business practices and the prohibition of interest (riba), can promote economic stability and equity. Additionally, concepts like waqf (endowment), zakat (charitable giving), and sadaqah (voluntary charity) are seen as potential means for wealth redistribution and poverty alleviation, which could have positive implications for economic development [4,5].

On the other hand, others suggest that certain interpretations of Islamic principles may pose challenges to economic growth, particularly in the context of global competitiveness. For instance, the strict adherence to Islamic finance principles may limit access to capital, and restrictions on certain financial practices might hinder the development of financial markets and institutions [6,7,8,9].

Moreover, the varied characteristics of countries where Islam is the predominant religion, encompassing differences in cultural norms, economic frameworks, and political structures, preclude the ability to make broad generalizations about the correlation between Islam and economic growth. Certain nations with a Muslim majority have witnessed notable economic expansion, whereas others have encountered difficulties in attaining persistant development.

In summary, the influence of Islam on economic growth in countries where it is the predominant religion is shaped by a range of factors extending beyond religious dimensions. It involves intricate connections encompassing economic policies, institutional frameworks, governance systems, human capital development, technological progress, and global economic trends. This study aims to fill this gap by examining the potential impact of Islamic teachings on economic growth, exploring the intersections of religious beliefs, economic policies, and developmental outcomes. Specifically, the research seeks to scrutinize the moderating role of Islamic principles (teachings and education) in the correlation between economic growth and human capital in the selected countries. Ultimately, this contributes to a more nuanced comprehension of the relationship between Islam and economic growth.

Therefore, the subsequent sections of the document are organized as follows: Section II conducts a review of the literature, concentrating on both empirical and theoretical perspectives. Section III outlines the research methodology, encompassing the theoretical and analytical framework. Section IV addresses the results and discussion, while Section V provides the conclusion along with policy recommendations.

2. LITERATURE REVIEW

2.1 Empirical Review

Khalfaoui [1] investigated the influence of Islam, measured as a percentage of the Muslim population, on economic growth and explored factors impacting this relationship using panel data from twenty Muslim countries (1990-2014). The findings suggested that Islam does not foster economic growth; its effect is relatively lower and negative, possibly due to high rates of illiteracy and unemployment in Muslim countries.

Uddin and Masih [5] examined the interplay of finance, growth, and human development in Malaysia from an Islamic economic development

perspective, utilizing the ARDL technique. They identified a long-term relationship between finance, growth, and human development in Malaysia.

Mifrahi &Tohirin [10] investigated QISMUT countries using annual panel data (2005-2015) and multiple mediating analysis models. The study revealed that Islamic banking financing does not directly impact economic growth significantly but could potentially influence it indirectly through investment and consumption spending.

Chani et al. [11] explored the long-run relationship between human capital investment and economic growth in 12 selected countries from SAARC and ASEAN regions (2001-2015) using FMOLS econometrics methods. The study found a positive link between education expenditure and economic growth.

Awan and Kamran (2017) analyzed the nexus between human capital investment and economic growth in Pakistan with annual data spanning 1985 to 2014, employing the Autoregressive Distributive Lag (ARDL) method. The results indicated a positive influence of human capital on the economic development of Pakistan.

Ali et al. [12] investigated the relationship between human capital, social capabilities, and economic development using 15 years of data (1996-2011) from 132 countries. The Panel ARDL technique revealed inclusive results, emphasizing the positive impact of both human capital and economic development.

Alataş and Çakir [13] explored the connection between education expenditure, spending on health, and economic development in a panel of 65 nations (1967-2011). FEM and REM were used for estimation, and the researchers concluded that investments in health and education have a positive and statistically significant effect on economic development.

2.2 Theoretical Review

2.2.1 Human capital development hypothesis

The impact of religion on educational attainment, which has a substantial impact on the development of human capital, is presented in this theory. Higher religious beliefs are seen to promote growth because they have an impact on personal behaviors that improve productivity, like work ethic or thrift, through human development capital, according to Bednarik and Filipova [14]. The idea is supported by an analysis of the interdependence between economic growth and human capital. On the one hand, human capital is one of the key drivers of economic growth, while on the other, the demand for human capital is influenced by economic growth [15]. Technological advancement drives demand for more human capital, or people with more education, which in turn drives economic growth.Higher demand for education and its increased significance for society are results of a more developed economy. This connection was particularly clear in history during the industrial revolution, when the importance of education for economic expansion expanded considerably.

Technological advancement, physical capital, and human capital are not the only elements that affect economic growth [16]. The neoclassical approach, which assumes an economy with no limitations and perfect competition, is the foundation of contemporary growth models. The truth, though, is the exact reverse. The environment in which economies operate has a big impact on them [17]. Every economy has unique qualities that may have an impact on how human capital, physical capital, and technical advancement interact in ways that do not require the growth theory to be accurate in its entirety [18].

According to Bednarik and Filipova [14], religion is frequently referred to as one of the institutional components of economic growth and has an integral role among these attributes. For instance, the Judaic-Christian tradition has been highlighted as a crucial component of the economic growth of Europe from the standpoint of history. The idea of rights to property has existed from the time of the Bible, and Christianity preserved and changed it [19]. The crises that resulted in Christianity's division were often tied to attempts to achieve political power. In the sixteenth century, the third and final break led to the development of Protestantism as a critique of Roman-Catholic Christianity, which had a positive impact on not only political regimes but also supported private property and individual freedom.

On the other hand, Islam is frequently seen as a hindrance to economic progress. Everything was ruled and controlled by religion, and the ideal government was that of holy men. The so-called eastern despotism was defined by the belief that the ruler, who was regarded as God, had the

right to dispose of the lives and property of his servants. Limited or nonexistent property rights and a lack of freedom naturally stifle business, competition, and economic growth. The contrary viewpoint, on the other hand, argues that Islam is not to blame for the economic underdevelopment of the Muslim world. They emphasize the importance of institutions [14].

In conclusion, one set of scholars and scientists, such as [20,19], or (Weber, 1930), contends that religion has a significant impact on the growth of the economy by influencing individual morals and values like honesty, frugality, the desire to work hard, and others. This argument is based on the disparity between the economies and living conditions of the Muslim world and those of Western Europe, North America, and other cultural outgrowths of Western Europe. The opponents of this strategy attempt to provide more comprehensive justifications by using Muslim views as dependent variables [3,21,22].

3. THEORETICAL FRAMEWORK AND METHODOLOGY

3.1 The Endogenous Growth Mode

This work distinguishes itself from neoclassical growth theories by emphasizing that economic growth is an inherent outcome of an economic system, not a result imposed from external forces. Romer (1996) specifies that the modeling of endogenous growth theory incorporates four variables: labor (L), capital (K), technology (A), and output (Y). The model is formulated in continuous terms.

A fraction a_L of the labor force is allocated to the R & D sector, while the fraction 1-a_L is devoted to the goods-producing sector. Similarly, a fraction a_k of the capital stock is utilized in R & D, with the remainder used in goods production. Both sectors utilize the complete stock of knowledge, A, as the utilization of knowledge in one sector does not preclude its use in another. The quantity of output produced at time t is thus:

$$Y(t) = [(1 - a_k)K(t)]^{\alpha}[A(t)(1 - a_L)L(t)]^{1-\alpha}, \quad 0 < \alpha < 1 \tag{3.1}$$

Apart from the terms $1 - a_k$and $1 - a_L$, and the constraint of the Cobb-Douglas functional form, it is important to recognize that equation (3.1) indicates constant returns to capital and labor: with a given technology, doubling the inputs results in a doubling of the output.

The generation of new ideas is contingent on the amounts of capital and labor involved in research, along with the technological level. Under the assumption of generalized Cobb-Douglas Production, we express this as:

$$\dot{A(t)} = B[a_k K(t)]^{\beta}[a_L L(t)]^{\gamma} A(t)^{\theta}, \quad B > 0, \beta \geq 0, \gamma \geq 0 \tag{3.2}$$

Where;

B is a shift parameter.

Observe that the knowledge production function exhibits increasing returns to scale with respect to capital and labor. Romer [23] emphasizes the positive externalities associated with both physical investment and knowledge, while Lucas (1988) highlights the positive externalities of human capital accumulation.

In view of these alternative sources for the accumulation of knowledge;

$$\text{Let} \quad K(t) = f[n(t), (A)] \tag{3.3}$$

In this context, where (A) represents the accumulated body of knowledge encompassing both religious and scientific domains, and n(t) denotes the count of available varieties, indicative of the cumulative domestic research conducted. Assuming the function is both increasing and homogenous of degree one in its argument, the function can be succinctly expressed as:

$$\varphi = f\left[1, \frac{A(t)}{n(t)}\right] \text{ such that } K = n\varphi\left(\frac{A}{n}\right), K = n\varphi\left(\frac{A}{n}\right), \varphi' > 0 \tag{3.4}$$

Entrepreneurs are assumed to engage freely in research and development (R&D), where the cost of developing a product at a specific point in time is determined to be $\frac{aW}{K}$, and the associated benefits are denoted as V, representing the value of a patent. Consequently, under the assumption of free entry, $V = \frac{aW}{K}$. The patent generates an unending stream of profits, π(t), derived from the sales of $x(t) = \frac{X(t)}{n(t)}$ units at a price dictated by $P_y = \frac{W}{a}$. The value of a patent at any given point ensures that the dividend rate on this asset, $\frac{\pi}{v}$, combined with the rate of capital gain, $\frac{\dot{v}}{v}$, delivers a "normal" rate of return.

This no-arbitrage condition implies:

$$\frac{(1-\alpha)X\varphi}{\alpha a} + \frac{\dot{w}}{w} - \frac{\dot{K}}{K} = r \quad (3.5)$$

In this context, r denotes the immediate interest rate on a consumption loan. The representative household optimizes an intertemporal utility function formulated as:

$$U_t = \int_t^{\infty} e^{-\rho(\tau-t)}\, log\, u\left[C_y(\tau), C_z(\tau)\right] d\tau\ , \quad (3.6)$$

Here, $C_i(\tau)$ signifies the consumption of the final good "i" at time τ. The utility function denotes instantaneous utility, assumed to exhibit non-decreasing, strictly quasi-concave properties and homogeneity of degree one in its arguments. The model is concluded with the labor market clearing condition:

$$\frac{ag}{\varphi} + x + L_Y = L \quad (3.7)$$

Here, L denotes the constant and inelastic labor supply. The three terms on the left-hand side (LHS) of the equation correspond to employment in research and development (R&D), intermediate production, and final production, respectively. The minimization of costs in the production of good Y establishes $\frac{L_Y}{X}$a function of $\frac{\rho_X}{w}$, which, according to pricing relations ($\overline{p} \equiv \frac{P_z}{P_Y}$), remains constant over time. Consequently, it can be deduced that L_Y is directly proportional to X, and the resource constraint can be formulated as:

$$\frac{ag}{\varphi} + b_L x = L \quad (3.8)$$

Therefore, at the steady state, $\frac{(1-\alpha)X\varphi}{\alpha a} + \frac{\dot{w}}{w} - \frac{\dot{K}}{K} = r()$ reduces to $\frac{(1-\alpha)X\varphi}{\alpha a} = g + \rho \quad (3.9)$

In the equilibrium state, the consumption of each good expands at a rate identical to that of final goods. Consequently, the trade volume increases at this rate, expressed as $\frac{\dot{T}}{T} = \frac{g\beta(1-\alpha)}{\alpha}$. It can be inferred that $\frac{T}{n}$will either diminish to zero, grow indefinitely, or converge to a constant in the long run, contingent on the following conditions: $\alpha > \beta(1-\alpha), \alpha < \beta(1-\alpha),$ or $\alpha = \beta(1-\alpha)$, respectively.

The model encapsulating the repercussions of Islam on economic growth in selected countries is an amalgamation of the aforementioned theoretical explanations and draws insights from the work of Wu et al. (2021), as cited in Afolabi [24]:

$$Eco_{Gro} = f(LFPR, HCI, GCFC, ISLAM, TOP) \quad (3.10)$$

Where;
Eco_Gro, LFPR, HCI,GCFC, ISLAM and TOP denote economic growth (proxied by Real Gross Domestic Product per Capita), labour force participation rate(to proxylabour), Human capital Index (HCI) to proxy human capital per person, gross consumption of fixed capital (GCFC) to proxy capital, ISLAM proxied by proportion of the total population that are Muslims, and trade openness (TOP) to capture international exposure of the economy; in that order. The determinants are all expressed in logarithms (rep by the prefix “ln”). Thus, elasticity is used to express how the independent variables affect the economic growth.

Equation (3.10) is represented explicitly as;

$$ln\, Eco\_Growth = \beta_0 + \beta_1 LFPR_{i,t} + \beta_2\, ln\, HC\, I_{i,t} + \beta_3 GCFC_{i,t} + \beta_4\, ln\, ISL\, AM_{i,t} + \beta_5\, ln\, TO\, P_{i,t} + \varepsilon_{i,t} \quad (3.11)$$

Where;
i represents a cross-section of countries; t stands for the years 2010 to 2021; β_0 is the intercept;β_1-β_4 are each variable's elasticities; and ε is the noise (error).

In this paper, we investigated whether the religion of Islam is actually not conducive to economic growth in the world. Equation (3.12), which provides a rich method of modeling the moderating impact that Islam has on the link between economic growth and human capital Index (HCI) in the selected countries, thereby captures its conditional impacts. The conditional effect is represented by include product of the Islam and HCI as one of the explanatory factors in the equation.

$$ln\, Eco\_Growth = \beta_0 + \beta_1 LFPR_{i,t} + \beta_2\, ln\, HC\, I_{i,t} + \beta_3 GCFC_{i,t} + \beta_4\, ln\, ISL\, AM_{i,t} + \beta_5\, ln\, TO\, P_{i,t} + \beta_4\, ln\, HCD\_ISL\, AM_{i,t} + \varepsilon_{i,t} \quad (3.12)$$

Where;

HCI_ISLAMP is the interactive term of human capital development and Islamic tenets; and all other factors stay the same as they were before. The total impact of Islam which includes its marginal influence on economic growth is arrived at by taking partial derivatives of equation (3.12):

$$\frac{\partial Eco\_Gro_{i,t}}{\partial HCI_{i,t}} = \beta_4 + \beta_5 ISLAM_{i,t} \quad (4)$$

The sign and magnitude of this equation should be considered while interpreting it. Considering the sign, if β_4 > 0 and β_5 < 0, HCI deteriorates economic growth due to overbearing tenets of Islam on HCI, and vice-versa. Meanwhile, if β_4 > 0 and β_5 > 0, then the tenets of Islam actually amplify HCI which in turns affects economic growth, and vice-versa. Considering the magnitude, if $\frac{\partial Eco\_Gro_{i,t}}{\partial HCI_{i,t}}$ > 0, HCI together with ISLAM enhances economic growth but if $\frac{\partial Eco\_Gro_{i,t}}{\partial HCI_{i,t}}$ > 0, the combination of HCI and ISLAM are not conducive to economic growth in the sampled countries.

3.2 Estimation Technique

This paper relies on the distinctive CS-ARDL estimating technique, developed by Chudik et al. [25], as the primary analytical method. The CS-ARDL incorporates elements of the Mean Group (MG) and Pool Mean Group (PMG) estimators, utilizing Chudik and Pesaran's [25] dynamic common correlated effects (DCCE) approach to address cross-sectional dependence. It takes into consideration heterogeneous slopes, allows for small numbers of samples, concurrently analyzes both long- and short-run models, handles the problem of cross-sectional dependence, and assumes that parameters are expressed by similar characteristics. Additionally, it can be applied if the panel data is uneven and the series contains structural breaks. These are the five explanations for why we selected this estimator over others. Using the panel ARDL/PMG estimator, the validity of the CS-ARDL estimates is evaluated. Equations (2) in the panel ARDL version are expressed as;

$$\Delta y_{it} = w_i + \delta_i(y_{i,t-1} - \theta_i' x_{i,t-1}) + \sum_{j-1}^{p-1} \phi_{ij} \Delta y_{i,t-j} + \sum_{j-0}^{q-1} \alpha_{ij} \Delta x_{i,t-j} + \varepsilon_{it} \quad (5)$$

Here, yit denotes the economic growth of country i at time t; α_{ij} represents a matrix of the regressors (factors); θ_i' establishes a relationship between y_{it} and x_{it}; in the long-run equilibrium, δ_i represents the error correction term; ϕ_{ij} and α_{ij} depict the connection between yit and xit in the short run; and the terms within parentheses signify the long-run linkage.

Chudik et al. [25] formulated the CS-ARDL model by incorporating cross-sectional averages into both the dependent and explanatory variables, addressing gradient asymmetry and cross-sectional associations. Equation (5) can be reformulated to express its CS-ARDL counterpart as follows:

$$\Delta y_{it} = \mu_i + \delta_i\left(y_{i,t-1} - \theta_i' x_{i,t-1} + \delta_i^{-1} n_i \overline{y_t} + \delta_i^{-1} \varphi_i' \overline{x_t}\right) + \sum_{j-1}^{p-1} \phi_{ij} \Delta y_{i,t-j} + \sum_{j-0}^{q-1} \alpha_{ij} \Delta x_{i,t-j} + \sum_{j-0}^{p-1} \tau_{ik} \Delta \bar{y}_{t-j} + \sum_{j-0}^{q-1} \Delta_{ik} \varphi \bar{x}_{t-j} + \varepsilon_{it} \quad (6)$$

Where;

$\overline{y_t}$ and $\overline{x_t}$ are the cross-sectional averages of the cause-and-effect factors, respectively.

Before applying the CS-ARDL, preliminary testing was conducted. These tests encompassed the panel unit root test, slope homogeneity test, cross-sectional dependence (CD) test, and panel cointegration test. It is imperative to conduct a CD test in panel data analysis to mitigate potential unclear and biased estimates resulting from variations in spatio-temporal features and spatial effects [24,26]. The CD test, initially introduced by Pesaran [27], is characterized as:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \rho ij\right) \quad (7)$$

In this context, the variables are defined as follows: T represents time, N represents the size of the panel data, and ρij represents the correlation coefficient. The alternative hypothesis posits a contradiction to the null hypothesis of the CD test, challenging the assertion that there is no cross-sectional dependence in the sampled nations.

Given the variations in both Islamic concentration and economic profiles among these countries, it becomes essential to conduct a test for slope homogeneity across the cross-sectional units subsequent to the CD test. Failing to account for slope heterogeneity can lead to inconsistent estimations [24], (Zuo et al., 2022). Therefore, this study employs the slope homogeneity test introduced by Pesaran and Yamagata [28]. The test statistic for this analysis is expressed as:

$$\tilde{\Delta}_{SH} = (N)^{\frac{1}{2}} (2K)^{-\frac{1}{2}} \left(\frac{1}{N} \tilde{S} - k\right) \quad (8)$$

$$\tilde{\Delta}_{ASH} = (N)^{\frac{1}{2}} \left(\frac{2k(T-k-1)}{T+1}\right)^{-\frac{1}{2}} \left(\frac{1}{N} \tilde{S} - k\right) \quad (9)$$

In this equation, Δ˜SH and Δ˜ASH represent delta tilde and adjusted delta tilde, respectively. The alternative hypothesis of the slope

homogeneity test posits that the gradients across cross-sectional units are not uniform, thereby contradicting the null hypothesis.

Following the slope homogeneity and cross-sectional dependence (CD) testing, the next step involved conducting the panel unit root test. First-generation unit root approaches, such as Im, Pesaran, and Shin (IPS) and Levin-Lin Chu, are insufficient in addressing cross-sectional dependence issues (Wu et al., 2021). Consequently, this study employs second-generation cross-sectional augmented CADF and IPS (CIPS) tests introduced by Pesaran (2007). These tests aim to determine the order of integration for each variable and to appropriately account for the observed cross-sectional dependence among the sampled nations. The formula for the CIPS test statistic is expressed as:

$$CIPS = \frac{1}{N}\sum_{i=1}^{n} \Delta CA_{i,t} \quad (10)$$

$$\Delta CA_{i,t} = \lambda_i + \lambda_i CA_{i,t-1} + \lambda_i \overline{CA_{t-1}} + \sum_{l=0}^{p} \lambda_{il} \Delta \overline{CA_{t-1}} + \sum_{l=0}^{p} \lambda_{il} \Delta CA_{i,t-1} + \mu_{it} \quad (11)$$

Where;

λ_i, $CA_{i,t-1}$, $\Delta CA_{i,t}$, $\overline{CA_{t-1}}$ and $\Delta\overline{CA_{t-1}}$ denotes the intercept, the cross-sectional units, its, first difference, its mean values, and the cross-sectional units' first difference, in that order.

Following the panel unit root test, the analysis proceeds to the panel cointegration test to evaluate the existence of long-term linkages between the variables. In contrast to widely recognized cointegration methods such as Kao and Pedroni, the Westerlund test, developed by Westerlund in 2007, offers more objective results by incorporating considerations for cross-sectional dependence (CD) and heterogeneity. The anticipated test results for the Westerlund test include:

$$\alpha_i(L)\Delta y_{it} = \delta_{1i} + \delta_{2i} t + \alpha_i(y_{it-} - \beta_i' x_{it-1} + \lambda_i(L)^{v_{it}}) + e_{it} \quad (12)$$

Where;

$\delta_{1i} = \alpha_i(1)\varphi_{2i} - \alpha_i\varphi_{1i} + \alpha_i\varphi_{2i}$ and $\delta_{2i} = -\alpha_i\varphi_{2i}$ β_i is the EC coefficient and α_i is the path in which the regressor and regressand cointegrate.

3.3 Data Descriptions and Sources

The study cut-across 47 countries due to the focus and scope of our study. The selected 47 countries (see the appendix) are divided into two strata of Muslim Countries and Non-Muslim Countries. Muslim Countries are those with Muslim proportion of total population of at least 90% in the year 2023, while the Non-Muslim Countries are those with Muslim proportion of total population of less than 1% (Al-Islam Portal 2023). We employed annual secondary data for the period of 2010-2021, in order to focus the study on the recent few years. Table 1 shows the description and the sources of variables:

Table 1. Data Descriptions and Sources

Variables	Definition	Description	Data Source
Economic Growth	Real *GDP per Capita*	Captured with RGDP per capita (US$ Billion 2015 constant)	World development Indicator, 2022
ISLAM	Tenets of Islam	Muslim Proportion of Total Population (%)	Al-Islam Portal (2023)
LFPF	Labor Factor Participation Rate	Labor force participation rate, total (% of total population ages 15+)	World development Indicator, 2022
GCI	Gross Capital Investment	Proxied with gross capital formation(% of GDP)	World development Indicator, 2022
TOP	Trade Openness	Captured with trade in % of GDP	World development Indicator, 2022
HCI	Human Capital Development	Captured with Index of Human Capital per person	Penn Table 10.0
HCD*ISLAM	Interaction between HCD and Islam	Captured with multiplication HCD and Islam	Derived

Source: Author's Compilation

4. EMPIRICAL ANALYSIS AND DISCUSSION OF RESULTS

4.1 Preliminary Analysis

The full sample (the total of the two groups), Muslim dominated countries (Muslim), and very scanty Muslim countries (Non_Muslim) are all represented by descriptive statistics in Table 2, as well as the important variables of interest. RGDPper capita averaged about US$7,629.27 across the entire sample, with gross fixed capital averaged US$26.17billion and HCI of 2.39. Meanwhile, labour participation rate averages 57.38% and trade openness is about 68.27%; surprisingly, the average proportion of Muslim is 51.1%. Among the Muslim countries, RGDP per capita averaged about US$6,200.13 with gross fixed capital averaged US$28.87billion and HCI of 2.09. Meanwhile, labour participation rate averages 51.48% and trade openness is about 66.41%; expectedly, the average Muslim population is 95%. Meanwhile, for Non-Muslim countries, RGDP per capita averaged about US$9,253.29 with gross fixed capital averaged US$23.10billion and HCI of 2.74. Meanwhile, labour participation rate averages 64.06% and trade openness is about 70.39%; as expected the average Muslim population is 0.13%. This shows that per capita RGDP, HCI, LFPR and TOP are greater among the non-Muslim countries than in the Muslim countries. This seems pointing that the environmental in the non-Muslim countries is more conducive than in the Muslim countries, all things being equal.

4.2 Correlation Analysis

The magnitude and direction of the correlations between the regressand and the relevant regressors are checked using the correlation test. The intensity of the association raises the question of whether multicollinearity exists or not. Table 2's correlation test results show that there are relatively minor correlations between the factors taken into account, with H_Islam having the strongest link with HCI in the Muslim countries. The outcome reveals an absence of multicollinearity in the model and that there is no particularly strong correlation between the variables. As a result, multicollinearity is not a concern when incorporating all the independent variables into the empirical model.

Table 2. Descriptive statistics

Full Sample					
Variable	Obs	Mean	Std. Dev.	Min	Max
RGDP	564	7629.27	11113.045	334.708	73493.269
GCFC	564	26.172	9.28	3.466	57.161
HCI	564	2.393	0.633	1.167	3.765
LFPR	563	57.377	11.974	33.707	87.89
TOP	564	68.269	29.152	4.128	186.468
ISLAM	564	51.1	47.982	0.01	99.9
H ISLAM	564	106.281	106.098	0.026	305.301
Muslim					
RGDP	300	6200.124	12892.744	334.708	73493.269
GCFC	300	28.871	10.899	3.466	57.161
HCI	300	2.086	0.547	1.167	3.259
LFPR	299	51.48	12.609	33.707	87.89
TOP	300	66.406	24.428	4.128	118.7
ISLAM	300	95.951	4.806	77.5	99.9
H ISLAM	300	199.493	50.716	114.75	305.301
Non_Muslim					
RGDP	264	9253.299	8391.718	1284.478	36138.529
GCFC	264	23.104	5.617	7.611	37.099
HCI	264	2.741	0.538	1.417	3.765
LFPR	264	64.056	6.477	51.07	79.24
TOP	264	70.387	33.651	15.683	186.468
ISLAM	264	0.133	0.105	0.01	0.5
H ISLAM	264	0.359	0.313	0.026	1.637

Source: Author's Compilation

Table 3. Correlation Matrix

Full Sample							
Variables	**RGDP**	**GCFC**	**HCI**	**LFPR**	**TOP**	**ISLAM**	**H ISLAM**
RGDP	1						
GCFC	0.068	1					
HCI	0.536	-0.136	1				
LFPR	0.365	-0.222	0.176	1			
TOP	0.127	0.399	0.181	0.026	1		
ISLAM	-0.181	0.312	-0.527	-0.561	-0.073	1	
HISLAM	-0.114	0.308	-0.465	-0.522	-0.08	0.983	1
Muslim							
RGDP	1						
GCFC	0.092	1					
HCI	0.464	-0.031	1				
LFPR	0.553	-0.145	-0.039	1			
TOP	0.234	0.458	0.162	-0.094	1		
ISLAM	-0.737	0.072	-0.259	-0.683	-0.052	1	
HISLAM	0.277	-0.036	0.97	-0.213	0.146	-0.024	1
Non_Muslim							
RGDP	1						
GCFC	0.202	1					
HCI	0.73	0.165	1				
LFPR	-0.34	0.227	-0.353	1			
TOP	-0.007	0.553	0.179	0.112	1		
ISLAM	-0.101	0.03	-0.102	-0.007	-0.119	1	
HISLAM	0.06	0.052	0.186	-0.178	-0.077	0.941	1

Source: Author's Compilation

4.3 Cross-sectional Dependence

Following the variance in the homogeneous features of the sampled countries, cross-sectional dependence (CD) testing is essential in panel analyses. The Pesaran CD test result is displayed in Table 3, and it shows that the null hypothesis of no CD could not be accepted at the 1% level of significance. As a result, the dynamics of variables (including per capita RGDP, GCFC, HCI, LFPR, TOP, HIslam) could affect other countries in the sample. This suggests that Muslim and Non-Muslim countries are cross-sectionally dependent. Overall, the outcome supports the sampled countries interconnectedness.

4.4 Analysis of The Unit Root

Following the CD test, stationarity tests utilizing appropriate techniques must be carried out. The CIPS and CADF unit root techniques, that is capable of successfully manage CD concerns, were introduced by Pesaran [27]. Table 4 presents the results of these two methods and shows that the variables have heterogeneous order of integration throughout the three models. Some of the series become stable at (I(0)), whereas others do not until they have first been differenced (I(1)). This satisfies a prerequisite for using the CS-ARDL framework. This finding raises the prospect that the variables could cointegrate, necessitating the execution of a cointegration test to explore this potential.

Table 4. Cross-sectional dependence

Variable	**Full Sample**	**Muslim**	**Non-Musli**
LnRGDP	32.8 (0.000)	7.71 (0.000)	28.33 (0.000)
lnGCFC	1.2 (0.228)	-0.72 (0.470)	5.67 (0.000)
lnHCI	13.24 (0.000)	26.48 (0.000)	52.56 (0.000)
lnLFPR	64.09 (0.000)	3.47 (0.001)	10.61 (0.0000)
lnTOP	19.41 (0.000)	8.47 (0.000)	11.33 (0.000)
lnHIslam	77.66 (0.000)	26.33 (0.000)	52.56 (0.000)

Source: Author's Compilation

Table 5. The unit root tests

Full Sample				
Variable	**CADF**		**CIPS**	
	Level	**First Diff**	**Level**	**First Diff**
lnRGDP	-1.374	22.522	-1.278	-2.959
lnGCFC	-1.28	2.61	-2.233	-2.942
lnHCI	-1.742	1.656	-2.266	-1.713
lnLFPR	2.027		-2.623*	
lnTOP	-1.486	2.61	-2.197	-3.054
lnIH_SLAM	-1.949	1.876	-3.054	-1.713
Muslim				
lnRGDP	-1.965	2.61	-1.243	-2.879
lnGCFC	-2.645	2.61	-2.496	-3.451
lnHCI	0.174	2.033	-0.322	-0.748
lnLFPR				
lnTOP	-1.375	2,61	-1.907	-3.088
lnIH_SLAM	-0.38	2.106	0.029	-0.748
Non-Muslim				
lnRGDP	-2.232	2.61	-1.565	-2.092
lnGCFC	-1.37	2.61	-1.968	-2.531
lnHCI	-3.023	0.83	-5.076	-4.024
lnLFPR	-1.306	2.61		
lnTOP	-1.205	2.61	-1.9	-2.554
lnIH_SLAM	-3.188	2.104	-5.076	-3.536

*Note: *, **, & *** are 1%, 5% & 10% level of sig. respectively*

Table 6. Testing for slope heterogeneity

Full Sample				
	MODEL A		**MODEL B**	
	SH	**ASH**	**SH**	**ASH**
VALUE	9.179	14.24	6.402	11.108
PROB	0.000	0	0	0
	Muslim Countries			
VALUE	3.721	5.778	1.956	3.399
PROB	0.000	0.000	0.05	0.001
	Non-Muslim Countries			
VALUE	5.881	9.11	4.014	6.953
PROB	0.000	0	0	0

Table 7. Cointegration Test

	Model A			**Model B**		
	Full Sample					
Statistic	Value	AV-period	P-value	Value	Z-value	P-value
Und_DF	1.074	9.979	0.142	1.074	9.979	0.142
Und_MDF	-0.267		0.395	-0.267		0.395
	Muslim Countries					
Und_DF	-0,756	9.96	0.225	-0.756	9.96	0.225
Und_MDF	-1.66		0.049	-1.66		0.049
	Non-Muslim Countries					
Und_DF	3.356	10	0.000	3.356	1.64	0.000
Und_MDF	4.105		0.000	4.105		0.000

Table 8. Empirical Analysis

	Model A			Model B		
	Full Sample	**Muslim**	**Non-Muslim**	**Full Sample**	**Muslim**	**Non-Muslim**
D.lnRGDP	**Coeff**	**Coeff**	**Coeff**	**Coeff**	**Coeff**	**Coeff**
ECT	-1.68(0.12)***	-1.71(0.21)***	-1.66(0.11)***	-1.68(0.12)***	-1.71(0.21)***	-1.66(0.11)***
	Short Run Est.			Short Run Est.		
lnRGDP(-1)	-0.68(0.12)***	-0.71(0.21)***	-0.66(0.11)***	-0.68(0.12)***	-0.71(0.21***	-0.66(0.11)***
lnGFCF	17.93(17.68)*	33.68(33.24)*	0. 03(0.13)	17.92(17.68)*	33.66(33.23)	0.03(0.13)
lnHCI	-8.82(8.62)	-16.65(16.17)	0.07(0.99)**	-8.77(8.33)	-16.04(15.62)	-0.51(1.45
lnLFPR	1.36(00.74)*	1.29(1.21)	1.45(0.82)*	1.36(0.74)*	1.29(1.21)*	1.45(0.82)*
lnTOP	-0.33(0.36)	-79(0.67)	0.19(0.09)**	-0.33(0.36)	-0.79(0.67)	0.19(0.09)*
lnISLAM	-0.05(0.57)	-0.60(0.88)	0.58(0.71)			
lnHCIISLAM				-0.05(0.57)	-0.60(0.87)	0.58(0.711)
	Long Run Est.			**Long Run Est.**		
lnGFCF	12.56(12.89)*	-23.71(24.24)	-0.06(0.08)	-12.59(12.89)	-23.72(24.25)	0.06(0.08)
lnHCI	6.01(6.25)	11.51(11.74)	-o.23(0.59)	5.46(6.05)*	10.82(11.35)	-0.63(0.85)
lnLFPR	1.33(0.52)	1.61(0.89)	1.02(0.49)	1.33(0.52)**	1.61(0.89)*	1.02(0.49)**
lnTOP	0.33(0.266)	0.43(0.49)	0.21(0.12)*	0.33(0.27)	0.43(0.49)	0.21(0.12)*
lnISLAM	0.33(0.41)*	0.69(0.61)*	0.39(0.55)			
lnHCIISLAM				0.55(0.41)	0.69(0.61)*	0.39(0.55)
	Diagnostics			**Diagnostics**		
Obs	469	249	220	469	249	220
Groups	47	25	22	47	25	22
RMSE	0.03	0.04	0.01	0.03	0.04	0.01
CD Statistic	1,5	0.94	-0.48	1.5	0.94	-0.48
P-value	0.1329	0.3471	0.6277	0.1327	0.3468	0.6279

*Note: ***p < 0.01, **p < 0.05, *p < 0.10*

4.5 Analysis of Homogeneity Slope

In order to ensure the reliability of panel estimators, it is imperative to ascertain the status of slope parameters prior to conducting panel data estimation. Both models, one without an interactive term of HCI and Islam (Model A), and the other with an interactive element (Model B), undergo the slope homogeneity test. As indicated in Table 5, which displays the outcomes of the slope homogeneity test devised by Pesaran and Yamagata [28], the null hypothesis asserting that the slope parameters are consistent across the three panels is rejected. The variability in slopes across the sampled nations is amply demonstrated by this result. Therefore, among other factors, the selected countries differ in their levels of Isam and economic growth.

4.6 Analysis of Cointegration

Due to the shortcomings of conventional cointegration test methodologies, the Westerlund (2007) 2nd-generation test was employed. in an attempt to remedy the longitudinal dependency observed across these countries. Table 6's cointegration result shows cointegration in all two of the panels for both Models A and B. This merely suggests that since these variables co-move over time, there is cointegration between RGDP, GCFC, HCI, TOP, LFPR, ISLAM, and H_ISLAM.

4.7 Presentation and Discussion of Empirical Results

Building on the insights gleaned from the preliminary tests, the CS-ARDL estimator was utilized to illuminate the relationship between Islam and economic growth in a selection of global economies (Model A). Additionally, this analysis aimed to evaluate the moderating effect of human capital development on this relationship (Model B). The results of the analysis, conducted across three panels comprising the complete sample, Muslim countries, and non-Muslim countries, are presented in Table 7. Long-run outcomes follow the short-run estimations, which are detailed in the upper section of the table.

According to the findings of Model A, the long-term analysis reveals a positive and statistically significant impact of Islam on economic growth among Muslim countries, while no significant impact is observed among non-Muslim countries. The positive effect implies that as the practice of Islam increases within the population, economic growth also rises within Muslim countries. This suggests that an enhanced adherence to Islam does not pose a threat to economic growth in the selected group of countries in the long term; however, in the short term, it appears to dampen economic growth. These results align with the conclusions drawn by Çamlıbel [29], suggesting that Islam, by itself, does not exert a negative effect on economic prosperity in Muslim countries.

In the short term, Model A indicates an unfavorable but statistically insignificant influence of Islam on economic growth in both the full sample and Muslim countries, while a favorable influence is observed among non-Muslim countries. This finding corresponds with the research of Khalfaoui and Guenichi [30] and Khalfaoui [1], suggesting that Islam does not inherently promote economic growth. Moreover, in both the short and long term, Model A reveals positive elasticities between gross fixed capital (GFCF) and economic growth (RGDP) as well as labor force participation (LFPR) in the selected countries. This empirical evidence underscores the notion that domestic capital stock and labor participation play integral roles in influencing economic growth in these countries. This result is consistent with the findings of Chani et al. [11] in Muslim and non-Muslim Asian countries, indicating a positive link between gross fixed capital formation, labor force, and economic growth. Thus, promoting economic growth in these countries hinges on the significant contributions of capital stock and labor force participation.

The development of human capital through education is recognized for its potential to significantly enhance economic performance. Similarly, Islamic education, encompassing aspects such as fiqh (monotheism), Islamic financing and banking practices (Musharaka, Mudharaba, Ijar, Sukuk, etc.), and principles like taqwa, influences the conduct and behaviors of the Muslim populace in the economy, thereby impacting economic growth in the country (Kahia et al., 2019; Kashem, 2017). Consequently, the human capital index (HCI) and Islam variables were interacted, and the outcomes, presented in Model B, are discussed below.

Specifically, when examining the moderating role of HCI on the relationship between economic growth and Islam in Muslim countries in the long

run, the results suggest that Islamic teachings and education contribute to the sophistication of the Muslim populace, indirectly enhancing economic growth. However, in the short run, Islamic teachings exhibit a dampening effect on economic growth, although this effect is not statistically significant. Meanwhile, in the full sample and non-Muslim results, a mixed indirect impact of Islamic education on economic growth is observed in the short run. However, in the long run, Islamic teachings among Muslims in these countries show a positive, albeit not significant, relationship between economic growth and Islam. This suggests that Islamic teachings, particularly in areas such as Islamic financing and banking, have contributed to economic growth in Muslim countries, rather than causing economic upturns or downturns.

These findings align with the conclusions of Chani et al. [11], who found that education in Muslim countries has a positive and statistically significant influence on economic development. Similarly, Fauzy et al. [31] identified a one-way causality relationship between Islamic education and economic growth in Malaysia, further supporting the idea that Islamic education contributes positively to economic development [32-35].

5. CONCLUSION AND RECOMMENDATION

Our findings indicate that, in the long run, Islam positively influences economic growth in Muslim countries but not significantly in non-Muslim countries. The increased practice of Islam correlates with higher economic growth in Muslim countries. In the short run, Islam has a dampening effect on economic growth. In both short and long terms, our result reveals positive elasticities between gross fixed capital and economic growth, as well as labor factor participation, emphasizing their crucial roles in promoting economic growth in these countries, in line with previous empirical studies.

Similarly, Islamic education, encompassing aspects like fiqh and Islamic finance, influences the conduct of the Muslim population, impacting economic growth. The interaction between the human capital index (HCI) and Islam variables reveals a positive, though not significant, relationship between Islamic teachings and economic growth in the long run. However, in the short run, Islamic education exhibits a dampening, yet not significant, indirect effect. In full and non-Muslim samples, a mixed short-term impact is found, while a positive, albeit not significant, relationship is observed in the long term.

Consequently, the following recommendations are advanced:

1. Promote policies that prioritize investment in Islamic education, including fiqh and Islamic finance, to enhance human capital. This can contribute to the sophistication of the Muslim populace, positively impacting economic growth in the long run.
2. Develop long-term economic plans that consider the positive influence of Islamic teachings on economic growth. Align policies with the goal of leveraging Islamic education to contribute to sustained economic development.
3. Integrate Islamic finance principles, such as Musharaka and Mudaraba, into economic policies to support a Sharia-compliant financial system. This can foster economic growth by aligning financial practices with Islamic teachings.
4. Strengthen efforts to enhance the Human Capital Index (HCI) by focusing on education and skills development. A well-educated and skilled workforce, coupled with Islamic teachings, can contribute to economic sophistication.
5. Prioritize policies that encourage investment in domestic capital stock. Given the positive elasticities between gross fixed capital and economic growth, fostering an environment conducive to capital formation can contribute to sustained economic development.
6. Develop initiatives to enhance labor force participation. Recognizing the positive influence of labor factor participation on economic growth, policies should aim to create opportunities for skill development, employment, and workforce engagement.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX

Descriptive Statistics

	rgdp	gcfc	hci	lfpr	top	islam
Afghanistan	570.175	49.655	1.779	46.641	103.448	34041222
Algeria	4077.504	44.274	2.499	41.485	59.01	39575438
Angola	2845.818	24.874	1.453	77.154	72.684	86284.351
Azerbaijan	5294.669	22.747	2.338	63.908	79.733	9400087.3
Bolivia	2911.848	19.266	2.855	69.719	67.375	11169.836
Brazil	8728.204	18.371	2.831	63.294	27.196	617430.67
Chile	13270.647	24.968	3.071	59.147	62.595	18131.129
Colombial	6016.479	21.861	2.510	67.847	37.197	95638.707
Costa Rica	11615.217	18.71	2.621	61.776	65.433	4909.268
Cuba	7434.217	10.882	2.621	55.319	37.286	11314.362
Dominican Rep	6970.705	24.913	2.625	61.009	53.303	10457.93
Ecuador	5828.159	26.328	2.737	64.332	51.271	16372.53
Egypt	3494.976	16.407	2.546	45.844	39.012	93283211
Estonia	18016.921	26.951	3.576	62.167	153.544	1322.672
Gambia	638.501	20.573	1.573	59.933	49.444	2203512.8
Guatemala	3982.687	14.711	1.868	60.402	52.283	15692.919
Guinea	819.609	26.313	1.544	55.395	89.762	10539280
Haiti	1374.153	18.153	2.625	65.771	41.549	10637.338
Indonesia	3370.491	33.595	2.344	66.919	42.981	2.253e+08
Iran	5221.241	33.647	2.338	41.765	45.283	81546054
Iraq	4411.008	18.575	2.238	41.75	66.188	36317023
Japan	34704.712	24.758	3.551	60.335	33.489	127069.05
Jordan	4256.632	26.353	2.850	38.732	99.608	8951777.5
Lao	2148.236	29.937	1.883	60.089	89.52	6856.58
Libya	9314.591	16.172	2.546	47.489	71.774	6137009.5
Mali	728.334	20.646	1.309	69.447	61.663	17951012
Mauritania	1552.922	42.872	1.752	42.068	92.2	3895718.2
Mexico	9584.638	22.295	2.698	60.261	71.858	12039.969
Morocco	3095.16	31.313	1.853	46.894	73.331	34492093
Nicaragua	1947.931	27.159	2.621	64.723	101.423	6347.325
Niger	483.336	29.661	1.199	74.93	42.459	20340308
Paraguay	5838.161	22.102	2.540	69.931	71.543	6227.339
Parkistan	1306.585	15.383	1.779	51.401	29.248	2.052e+08
Peru	6041.498	22.687	2.769	76.245	49.197	31195.734
Poland	13024.462	20.675	3.355	56.83	96.083	7595.648
Qatar	65612.724	36.712	2.963	87.111	94.305	1835289.2
Romania	9483.412	25.203	3.196	54.37	81.656	98617.689
S.Korea	29091.774	31.315	3.630	62.673	85.427	50949.317
Saudi Arabia	19529.465	28.548	2.625	56.515	69.362	31837768
Senegal	1276.062	27.96	1.544	48.136	59.683	14203963
Somalia	389.752	49.391	1.377	34.234	99.385	14201665
Sudan	2126.924	13.504	1.571	48.679	20.28	37589625
Tajikistan	1007.568	31.991	3.070	41.937	63.477	8465025.5
Tunisia	3910.064	21.422	2.499	46.776	95.937	11352389
Turkey	10877.659	29.114	2.379	50.86	55.945	78015517
Vietnam	2712.694	32.171	2.673	75.833	146.592	92560.288
Yemen	1637.152	34.957	1.640	37.755	56.635	28075255

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