

THE MODERATING ROLE OF FINANCIAL DEVELOPMENT IN THE HUMAN CAPITAL-GROWTH NEXUS: EVIDENCE FROM MIDDLE INCOME COUNTRIES

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Abstract

This study investigates the moderating role of financial development in the relationship between human capital and economic growth in middle-income countries. Using panel data from the World Development Indicators (WDI), the study employs Ordinary Least Squares (OLS), Fixed Effects (FE), Random Effects (RE), Structural Equation Modeling (SEM), and MEDSEM analysis. Human capital is measured through a PCA-based Human Capital Index (HCI) and the World Bank Human Capital Development Index (HCD), while financial development is proxied by domestic credit to the private sector. The findings reveal that both human capital and financial development positively and significantly influence economic growth. The interaction term between human capital and financial development is also positive and significant, indicating that financial development strengthens the growth-enhancing effect of human capital. Furthermore, mediation analysis shows that financial development partially transmits the impact of human capital on economic growth. The study concludes that human capital and financial development are complementary drivers of economic growth and recommends simultaneous investment in education and financial sector development to achieve sustainable economic growth in middle-income countries.

1. INTRODUCTION

Economic growth remains one of the key objectives of both developed and developing economies around the world because sustained economic growth enhance living standards, reduces poverty, increases employment opportunities, and enhances social wellbeing of the people. Over the last few decades, economists and policymakers have increasingly recognized that economic growth is not driven solely by physical capital accumulation and technological advancement, but also by the quality of human resources and the efficiency of financial systems. In this regard, human capital and financial

development have emerged as two critical determinants of long-run economic growth. Human capital enhances labor productivity, innovation, and technological adaptation, while financial development facilitates efficient allocation of resources, mobilization of savings, and investment expansion. The interaction between these two factors has therefore attracted significant attention in contemporary economic growth literature.

Economic growth remains one of the primary objectives of countries around the world because it improves living standards, reduces poverty, creates employment opportunities, and enhances

social welfare. However, achieving sustainable economic growth remains a major challenge, particularly for middle-income countries that are undergoing structural transformation and economic transition. Middle-income countries occupy an important position in the global economy because they account for a large share of the world's population, production, trade, and investment activities. Despite experiencing moderate industrialization and economic progress, many middle-income economies continue to face challenges related to productivity, technological advancement, institutional inefficiencies, and financial constraints. Consequently, understanding the factors that drive sustainable economic growth in middle-income countries has become increasingly important in development economics.

Traditional economic growth theories mainly focused on physical capital accumulation and labor expansion as the major determinants of economic growth. However, modern growth theories increasingly recognize that sustainable economic development depends heavily on human capital accumulation and financial development. Human capital and financial development are now considered two of the most significant drivers of long-run economic growth because they enhance productivity, innovation, technological progress, and investment efficiency. Endogenous growth theory particularly emphasizes the role of education, knowledge, innovation, and institutional development in sustaining economic expansion over time. Therefore, the relationship among human capital, financial development, and economic growth has attracted considerable attention from researchers and policymakers, especially in middle-income countries where economic transformation depends heavily on productivity improvement and financial sector development.

The concept of human capital gained prominence through the pioneering contributions of Schultz and Zaman (2001), who argued that investment in education, health, and skills development enhances labor productivity and contributes significantly to economic progress. Similarly, Becker (1989) explained that education and

training improve workers' knowledge, competencies, and productive abilities, thereby increasing economic efficiency. Human capital accumulation therefore enables economies to improve innovation capacity, technological adaptation, and labor productivity. According to Lucas Jr (1988), human capital generates positive externalities through knowledge spillovers and learning effects, which sustain long-run economic growth. Romer (1990) also argued that knowledge and technological innovation are central drivers of economic development in modern economies.

Human capital is particularly important for middle-income countries because these economies are often transitioning from labor-intensive production toward technology-intensive and knowledge-based industries. To sustain economic growth, middle-income economies must improve labor productivity, technological capabilities, and innovation performance. Hanushek and Woessmann (2020) argued that educational quality and cognitive skills significantly influence long-run economic growth by enhancing technological adaptation and productivity. Similarly, Barro (2001) found that educational attainment positively contributes to economic performance through improved labor efficiency and technological progress.

In middle-income countries, investment in education and health has increased substantially over recent decades. Many countries have improved school enrollment rates, literacy levels, and healthcare infrastructure. Despite these improvements, economic growth performance remains uneven across middle-income economies. Some countries have successfully transformed human capital investments into sustained economic growth, while others continue to experience slow productivity growth, unemployment, and economic instability. This suggests that human capital alone may not be sufficient to generate sustainable growth unless supported by effective institutional and financial structures.

One of the most important complementary factors influencing the effectiveness of human capital is financial development. Financial development refers to the improvement and expansion of

financial institutions, financial markets, and financial services that facilitate savings mobilization, investment financing, and efficient allocation of resources. Financial systems perform essential economic functions by channeling funds from savers to investors, reducing transaction costs, facilitating risk diversification, and supporting entrepreneurial activities. Schumpeter (1911) argued that financial institutions play a critical role in promoting economic development by financing innovation and productive investment activities. Similarly, M. R. Levine (2021); R. Levine (2018) explained that financial development promotes economic growth through efficient capital allocation, technological innovation, and investment facilitation.

Middle-income countries have experienced significant financial sector reforms and financial liberalization over the past few decades. Banking sectors have expanded, stock markets have developed, and financial inclusion has improved in many economies. However, substantial differences in financial development still exist across middle-income countries. Some economies possess relatively advanced banking systems and capital markets, while others continue to face financial inefficiencies, limited access to credit, weak financial institutions, and underdeveloped capital markets. These financial constraints may limit the productive utilization of human capital and reduce economic growth potential.

Financial development is particularly important for human capital utilization because educated individuals and skilled entrepreneurs often require financial resources to engage in productive economic activities. Firms also require financing to employ skilled labor, adopt advanced technologies, and expand production. In financially developed economies, individuals and businesses can access credit more easily for education, innovation, and investment activities. Conversely, weak financial systems may restrict access to credit and limit entrepreneurial opportunities, thereby reducing the economic returns from human capital investment. Levine (2005) argued that inefficient financial systems constrain productive investment and reduce

economic efficiency by limiting access to financial resources.

The interaction between human capital and financial development has therefore become an increasingly important issue in development economics. Financial development may strengthen the positive impact of human capital on economic growth by providing the financial resources necessary for productive investment and innovation. Educated individuals can utilize their skills more effectively in economies with efficient financial systems that support entrepreneurship, technological adoption, and investment expansion. Similarly, businesses operating in financially developed economies are more capable of utilizing skilled labor and investing in innovation activities. Therefore, the contribution of human capital to economic growth may depend significantly on the level of financial development. Several empirical studies have emphasized the complementary relationship between human capital and financial development. King and Levine (1993) found that financial development enhances productivity growth and investment efficiency, thereby supporting long-run economic growth. Baldacci et al. (2008) argued that public investment in education and health contributes more effectively to economic growth when supported by efficient financial systems. Similarly, Sehrawat and Giri (2016) reported that financial development improves the productive utilization of human capital by increasing financial accessibility and investment opportunities.

Recent studies focusing on developing and emerging economies also support the moderating role of financial development. Sethi, Bhattacharjee, Chakrabarti, and Tiwari (2021) found that countries with developed financial systems derive greater economic benefits from educational attainment and technological innovation. Likewise, Kim and Lin (2017) argued that financial development enhances the productivity of human capital by facilitating entrepreneurial financing and technological diffusion. These findings suggest that financial development may amplify the growth-enhancing effect of human capital, particularly in economies undergoing structural transformation.

The moderating role of financial development is especially relevant for middle-income countries because these economies often experience substantial financial and institutional challenges during the transition toward advanced economic structures. Middle-income countries typically face issues such as limited financial inclusion, inefficient banking systems, high borrowing costs, weak institutional quality, and technological gaps. These constraints may reduce the effectiveness of human capital investment and limit productivity growth. Therefore, understanding how financial development influences the human capital-growth relationship is essential for designing effective development strategies in middle-income economies. Moreover, globalization and technological transformation have increased the importance of both human capital and financial development in middle-income countries. The global economy increasingly depends on knowledge-based production, technological innovation, and skilled labor. Middle-income countries seeking to escape the “middle-income trap” must improve productivity, innovation, and industrial competitiveness. Aghion, Howitt, and Mayer-Foulkes (2005) argued that financial development promotes innovation-driven growth by supporting research and development activities. Educated populations become more productive when financial systems facilitate investment in technology, entrepreneurship, and industrial modernization.

Despite extensive literature on human capital and financial development, several important gaps remain unresolved. First, many previous studies examined human capital and financial development separately rather than analyzing their interaction effects. Second, empirical evidence regarding the moderating role of financial development remains limited, especially in the context of middle-income countries. Third, the effectiveness of financial development may vary across countries depending on institutional quality, financial efficiency, and macroeconomic conditions. Consequently, further investigation is required to understand whether financial development strengthens the impact of human

capital on economic growth in middle-income economies.

This study therefore examines the moderating role of financial development in the human capital-growth nexus using a sample of middle-income countries. Specifically, the study investigates whether financial development enhances the positive effect of human capital on economic growth. Human capital is proxied using educational indicators, while financial development is measured through domestic credit to the private sector obtained from the World Development Indicators (WDI) database of the World Bank. Economic growth is measured using GDP growth rates, while inflation, trade openness, and foreign direct investment are included as control variables.

The study contributes to the existing literature in several ways. First, it focuses specifically on middle-income countries, which represent an important but relatively underexplored group in the human capital-finance-growth literature. Second, the study incorporates an interaction term between human capital and financial development to examine the moderating effect of financial development. Third, the study uses panel data analysis, which enables examination of both cross-country and time-series variations. The findings of this study are expected to provide important policy implications for middle-income countries. If financial development positively moderates the relationship between human capital and economic growth, policymakers should simultaneously prioritize educational investment and financial sector reforms. Improving education without strengthening financial systems may reduce the economic returns from human capital investment. Similarly, policies aimed at enhancing financial inclusion, banking efficiency, and credit accessibility may improve the productive utilization of human capital and support sustainable economic growth.

Furthermore, the study contributes to the achievement of the Sustainable Development Goals (SDGs), particularly SDG 4 relating to quality education and SDG 8 concerning sustainable economic growth and productive employment. Human capital development and

financial inclusion are increasingly recognized as essential components of inclusive and sustainable development strategies. Understanding the interaction between these factors may therefore help middle-income countries formulate more effective economic policies for achieving long-run economic prosperity.

From a theoretical perspective, this study integrates Human Capital Theory, Endogenous Growth Theory, and Financial Intermediation Theory. Human Capital Theory explains how investment in education and skills enhances productivity and economic performance. Endogenous Growth Theory emphasizes the role of knowledge, innovation, and technological progress in sustaining economic growth. Financial Intermediation Theory highlights the importance of financial institutions in mobilizing savings, allocating resources efficiently, and facilitating productive investment. Combining these theoretical perspectives suggests that financial development may strengthen the growth-enhancing effect of human capital by reducing financial constraints and supporting innovation-driven economic activities.

In conclusion, human capital and financial development are both critical determinants of sustainable economic growth in middle-income countries. However, the effectiveness of human capital may depend significantly on the level of financial development within an economy. Efficient financial systems provide the financial resources and institutional support necessary for transforming education and skills into productive economic outcomes. Consequently, examining the moderating role of financial development in the human capital-growth nexus provides valuable insights into how middle-income countries can better utilize human capital for achieving sustainable economic growth and long-term economic transformation.

1. Literature Review

Human capital has long been recognized as one of the major determinants of economic growth and development. The concept became prominent through the pioneering work of Schultz and Zaman (2001) and Becker (1989) who argued that

investment in education, training, and health improves labor productivity and enhances economic performance. Human capital refers to the knowledge, skills, competencies, and health conditions embodied in individuals that increase their productive capacities. Unlike physical capital, human capital is accumulated through educational attainment, healthcare improvements, and professional training. According to Human Capital Theory, economies that invest heavily in human development are more likely to achieve sustainable economic growth because educated and healthy individuals contribute more effectively to productive economic activities.

The role of human capital is particularly important in middle-income countries because these economies are undergoing structural transformation from labor-intensive production toward industrialized and knowledge-based economic systems. Middle-income countries require skilled labor, technological adaptation, and innovation capacity to sustain economic growth and avoid the middle-income trap. Schultz and Zaman (2001) argued that educational and health expenditures should be treated as productive investments because they generate long-term economic returns. Becker (1989) further explained that human capital improves workers' efficiency, innovative capacity, and productivity, thereby increasing economic performance.

Endogenous growth theorists further strengthened the relationship between human capital and economic growth. Lucas Jr (1988) argued that human capital generates positive externalities through knowledge spillovers and learning-by-doing effects. According to Lucas Jr (1988) educated individuals not only increase their own productivity but also contribute to the productivity of society through knowledge diffusion and technological adoption. Similarly, Romer (1990) emphasized that knowledge creation and technological innovation are central drivers of long-run economic growth. Romer (1990) argued that economies with higher levels of human capital are more capable of generating innovation and technological advancement, leading to sustainable economic expansion. The positive contribution of human capital to

economic growth has been widely supported in empirical literature. Barro (2001) found that educational attainment significantly improves economic performance by enhancing labor productivity and technological adaptation. Hanushek and Woessmann (2020) further argued that educational quality rather than educational quantity is crucial for promoting long-run economic growth. Their findings suggested that countries with higher cognitive skills and better educational systems experience faster economic growth rates.

In middle-income countries, educational expansion and healthcare improvements have increased significantly during recent decades. Many middle-income economies have improved school enrollment rates, literacy levels, and healthcare infrastructure using policy reforms and public investment programs. However, economic growth performance across middle-income countries remains uneven. Some economies have successfully transformed human capital investment into sustained economic growth, while others continue to experience low productivity growth, unemployment, and economic instability. This suggests that human capital alone may not guarantee sustainable growth unless supported by complementary economic and financial structures. Health-related indicators of human capital also play an important role in economic growth. Bloom, Canning, and Sevilla (2004) argued that healthier populations contribute more effectively to productivity because healthy workers possess greater physical and mental capacity to participate in economic activities. Similarly, Well (2007) found that improvements in life expectancy positively affect labor productivity and economic performance. Health investment therefore complements educational investment in improving human capital accumulation.

Despite strong theoretical and empirical support for the human capital-growth relationship, several studies have reported mixed findings, especially in developing and middle-income economies. Pritchett and Pritchett (1999) argued that educational expansion does not always translate into economic growth because many developing economies fail to absorb educated labor into

productive sectors. According to Pritchett and Pritchett (1999) weak institutions, labor market inefficiencies, and inadequate investment opportunities reduce the economic returns to education. Similarly, Benhabib and Spiegel (1994) found that human capital contributes to growth primarily through technological adoption rather than direct productivity enhancement. These findings suggest that the effectiveness of human capital may depend significantly on institutional quality and financial development.

2.1 Financial Development and Economic Growth in Middle-Income Countries

Financial development has emerged as another important determinant of economic growth in modern economic literature. The finance-growth relationship was initially highlighted by Schumpeter (1911) who argued that financial institutions promote economic development by financing entrepreneurial innovation and productive investment activities. According to Schumpeter (1911), banks and financial intermediaries facilitate economic growth by allocating financial resources toward productive sectors and supporting industrial and technological development.

The importance of financial development is especially relevant for middle-income countries because these economies require substantial financial resources to support industrialization, infrastructure development, technological modernization, and private sector expansion. Middle-income countries have experienced significant financial reforms and financial liberalization over recent decades, resulting in banking sector expansion, increased credit availability, and capital market development. However, large differences in financial development continue to exist among middle-income economies. Theoretical foundations of financial development were further expanded by McKinnon (2010) and Shaw (1973), who criticized financial repression policies and argued that liberalized financial systems improve savings mobilization and investment efficiency. McKinnon (2010) argued that financially repressed economies suffer from inefficient capital

allocation and low investment, thereby limiting economic growth. Shaw (1973) similarly explained that financial liberalization improves financial intermediation and facilitates productive investment activities.

M. R. Levine (2021); R. Levine (1997, 2018) provided one of the most comprehensive explanations of the finance-growth nexus. Levine (1997) argued that financial development promotes economic growth through several channels, including savings mobilization, efficient resource allocation, risk diversification, investment monitoring, and technological innovation. Developed financial systems reduce information asymmetries and transaction costs, thereby improving economic efficiency and investment productivity. Empirical studies generally support the positive relationship between financial development and economic growth. King and Levine (1993) found that financial development indicators such as private sector credit positively influence long-run economic growth. Similarly, Beck (2002); Becker (1989) argued that financial intermediaries significantly improve productivity growth and capital accumulation. Financial development therefore contributes to economic growth by increasing access to investment financing and improving resource allocation efficiency.

In middle-income countries, financial development plays a particularly important role because many firms and entrepreneurs face financial constraints that limit productive investment activities. Developed financial systems provide businesses and households with access to credit, investment financing, and financial services necessary for economic expansion. Conversely, weak financial systems characterized by limited financial inclusion, high borrowing costs, banking inefficiencies, and inadequate access to credit may reduce investment opportunities and economic productivity. However, recent literature has questioned the universally positive relationship between financial development and economic growth. Arcand, Berkes, and Panizza (2015) argued that excessive financial development may negatively affect economic growth beyond certain thresholds. Similarly, Law and Singh (2014) found

that too much finance may harm growth due to financial instability and inefficient allocation of financial resources. These findings suggest that the relationship between financial development and growth may be nonlinear and context-dependent, especially in developing and middle-income economies.

2.2 Human Capital and Financial Development Nexus in Middle-Income Countries

Recent literature increasingly recognizes the complementary relationship between human capital and financial development. Financial development can strengthen the effectiveness of human capital by providing financial resources necessary for productive investment, entrepreneurship, technological adoption, and innovation activities. Educated individuals often require access to financial resources to establish businesses, pursue innovation, and utilize their skills effectively. Therefore, the productive contribution of human capital may depend significantly on the level of financial development within an economy.

This relationship is highly relevant in middle-income countries because these economies often experience structural constraints, financial inefficiencies, and limited entrepreneurial financing. In many middle-income economies, educational attainment has improved significantly, but inadequate financial systems continue to restrict investment opportunities and productive utilization of skilled labor. Consequently, understanding the interaction between human capital and financial development is important for sustaining long-run economic growth.

Galor and Zeira (1993) developed a theoretical model demonstrating that financial market imperfections limit educational investment and human capital accumulation. According to Galor and Zeira (1993), borrowing constraints prevent low-income households from investing in education, thereby reducing long-run economic growth. Financial development can therefore improve human capital accumulation by easing financial constraints and increasing educational accessibility. Similarly, Blackburn and Hung (1998) argued that financial intermediaries promote

growth by supporting human capital formation and technological innovation. Financial institutions facilitate educational investment and entrepreneurial activities by providing loans and financial services to individuals and firms. Consequently, economies with developed financial systems are more capable of utilizing human capital effectively. Empirical evidence also supports the complementary relationship between human capital and financial development. Baldacci, Clements, Gupta, and Cui (2008) found that public investment in education and health contributes more effectively to economic growth when supported by efficient financial systems. Similarly, Sehrawat and Giri (2016) argued that financial development enhances the productive utilization of human capital by increasing investment opportunities and financial accessibility.

Sethi et al. (2021) further reported that economies with developed financial systems derive greater economic benefits from educational investment and innovation activities. Likewise, Kim and Lin (2017) argued that financial development improves human capital productivity by facilitating entrepreneurial financing and technological diffusion. These findings are particularly relevant for middle-income countries where economic transformation depends heavily on innovation, industrialization, and technological adaptation.

2.3 Moderating Role of Financial Development in Middle-Income Countries

The moderating role of financial development in the human capital-growth nexus has become an increasingly important topic in development economics. Moderation occurs when the relationship between two variables depends on a third variable. In this study, financial development is expected to moderate the relationship between human capital and economic growth in middle-income countries.

Theoretically, financial development enhances the economic returns to human capital through several channels. First, developed financial systems improve access to credit for educated individuals and entrepreneurs. Skilled individuals often

require financing to establish businesses, invest in innovation, and adopt advanced technologies. Without adequate financial support, the productive potential of human capital may remain underutilized. Second, financial development promotes technological innovation and research activities. Aghion et al. (2005) argued that financial development supports innovation-driven growth by facilitating research and development investment. Skilled labor becomes more productive when financial institutions allocate resources efficiently toward productive and innovative activities.

Third, financial development improves investment efficiency and labor market productivity. R. Levine (1997) argued that developed financial systems reduce information asymmetries and transaction costs, thereby increasing investment efficiency and economic productivity. Consequently, middle-income countries with efficient financial systems are better able to transform human capital into productive economic activities. Empirical evidence increasingly supports the moderating role of financial development. Ibrahim and Ibrahim and Alagidede (2018) found that financial development strengthens the impact of education on economic growth in developing economies. Similarly, Zhang and Zhou (2021) argued that financial development enhances technological adoption and innovation capacity, thereby increasing the productivity of human capital.

However, weak financial systems may reduce the growth-enhancing effect of human capital in middle-income countries. Financial inefficiencies, limited credit access, weak banking systems, and low financial inclusion may prevent educated individuals and firms from utilizing their productive capacities effectively. Consequently, human capital investment may fail to generate substantial economic returns in financially constrained economies.

Theoretical Framework

This study is primarily grounded in Human Capital Theory, Endogenous Growth Theory, and Financial Intermediation Theory. Human Capital Theory was mainly developed by Schultz (1961)

and Becker (1964). The theory argues that investment in education, training, and health increases labor productivity and economic efficiency. In middle-income countries, human capital accumulation is essential for improving productivity, industrial competitiveness, and technological adaptation. Endogenous Growth Theory, proposed by Lucas (1988) and Romer (1990), emphasizes that economic growth is generated internally through innovation, knowledge accumulation, and human capital development. The theory suggests that economies with skilled labor and technological capabilities experience sustained long-run growth.

Financial Intermediation Theory explains the role of financial institutions in mobilizing savings, allocating resources, reducing transaction costs, and facilitating productive investment. Levine (1997) argued that efficient financial systems improve economic performance by supporting innovation and capital accumulation. Combining these theories suggests that financial development enhances the productivity of human capital by reducing financial constraints and supporting innovation-driven economic activities in middle-income countries.

Based on the theoretical and empirical literature, the following hypotheses are developed:

H1: Human capital positively affects economic growth in middle-income countries.

H2: Financial development positively affects economic growth in middle-income countries.

H3: Financial development positively moderates the relationship between human capital and economic growth in middle-income countries.

2. Data Sample and Model Specification and Methodology

This study investigates the moderating role of financial development in the relationship between human capital and economic growth in middle-income countries. The study adopts a panel data framework to examine whether financial development strengthens and enhance the economic growth through human capital development. The empirical model is developed based on the theoretical foundations of Human Capital Theory, Endogenous Growth Theory, and Financial Intermediation Theory. These theories collectively suggest that human capital contributes positively to economic growth, while financial development facilitates efficient allocation of resources and supports productive investment activities.

The baseline econometric model of the study is specified as follows:

$$GDPPC_{it} = \beta_0 + \beta_1 HC_{it} + \beta_2 FD_{it} + \beta_3 HCIFD + \beta_4 INF_{it} + \beta_5 TRADE_{it} + \beta_6 FDI_{it} + \beta_7 POP + \mu_{it}$$

Where GDPPC represents per capita income HC_{it} represents human capital FD_{it} represents financial development $HCIFD_{it}$ represents the interaction term between human capital and financial development $INFLATION_{it}$ represents inflation $TRADE_{it}$ represents trade openness FDI_{it} represents foreign direct investment. The inclusion of the interaction term HCIFD enables the study to examine whether financial development moderates the relationship between human capital and economic growth. According to moderation theory, the effect of one explanatory variable on the dependent variable depends on the level of another explanatory variable. Therefore, the coefficient of the interaction term β_3 indicates whether financial development strengthens or weakens the impact of

human capital on economic growth. We assume positive significant interaction term implies that financial development enhances the growth effect of human capital. Conversely, a negative coefficient would indicate that financial development weakens the contribution of human capital to economic growth. We in our study used economics growth measured as the purchase power parity (PPP) per capital income obtained from the world bank development indicators database. GDP growth is widely used in empirical growth literature as a proxy for economic performance because it captures changes in the value of goods and services produced within an economy over time. Barro (2001) argued that GDP growth is one of the most appropriate indicators for measuring macroeconomic

performance and economic progress. Similarly, R. Levine (1997) used GDP growth extensively in finance-growth literature.

The major independent variable of our study is human capital development is one of the key explanatory variables of the study. Human capital reflects the education, knowledge, skills, and health conditions of individuals that enhance productivity and economic performance. In our study we used two indices for human capital development one index constructed by world bank HCD second index HCI, we developed by ourselves using principal component analysis (PCA). For development of HCI using PCA we used four variables primary, secondary, tertiary enrollment of the students and government expenditure on education taken from world bank development indicators WDI. School enrollment is widely used in growth literature because it captures educational participation and skill development within an economy. Lucas Jr (1988) argued that education increases labor productivity and promotes knowledge spillovers that stimulate long-run economic growth. Similarly, Hanushek and Woessmann (2020) found that educational attainment significantly improves economic productivity and technological advancement. The expected sign of human capital is positive because higher educational attainment enhances workforce productivity, innovation, and technological adoption. Similarly, government expenditure is on education also improve the education quality and productivity.

Financial development represents the moderating variable in the study. Financial development is measured using domestic credit to the private sector (% of GDP), obtained from WDI. This indicator measures financial resources provided to the private sector by financial institutions relative to GDP. It is one of the most commonly used proxies for financial development in empirical literature. R. Levine (1997) argued that domestic credit to the private sector reflects the efficiency of financial intermediation and the ability of financial institutions to allocate resources toward productive investment activities. King and Levine (1993) also employed private sector credit as a measure of financial development and found that

financial development positively contributes to economic growth. Financial development facilitates investment, entrepreneurship, technological innovation, and productive resource allocation. We are expecting positive sign of financial development. The interaction term of financial development FD and human capital development HCI is included to capture the moderating role of financial development in the human capital-growth nexus. The interaction term examines whether the effect of human capital on economic growth depends on the level of financial development. Financially developed economies may derive greater benefits from human capital because developed financial systems provide credit access, investment opportunities, and support for innovation activities. A positive coefficient of the interaction term would imply that financial development strengthens the positive effect of human capital on economic growth. We are expecting mediating roles of financial development in the human capital development economic growth nexus.

We use used control variables to control for other impact on economic growth and analyze the true impact of our explanatory variables HCI and FD impact on economic growth. One of the control variables we used is Inflation is included as a macroeconomic control variable and is measured using consumer price inflation. Inflation affects economic growth through macroeconomic stability, purchasing power, and investment decisions. High inflation may reduce investment and economic efficiency by increasing uncertainty. Fischer (1993) argued that macroeconomic instability negatively affects long-run economic growth. Trade openness is measured as trade (% of GDP). Trade openness reflects the degree of integration of an economy with international markets. Openness to trade facilitates technological diffusion, market expansion, and productivity enhancement. Grossman and Helpman (1993) argued that international trade promotes innovation and economic growth through knowledge spillovers and competition effects. Foreign direct investment is measured using net inflows (% of GDP), obtained from WDI with indicator. FDI contributes to economic

growth through capital inflows, technological transfer, managerial expertise, and employment generation. Borensztein, De Gregorio, and Lee (1998) found that FDI promotes economic growth particularly in countries with sufficient human capital.

Our study sample focuses on middle-income countries classified according to the World Bank income classification. Middle-income countries are selected because they represent economies undergoing structural transformation, industrialization, and financial sector expansion. These countries also experience significant variations in educational attainment, financial development, and economic growth, making them appropriate for examining the interaction between human capital and financial development. Middle-income countries provide a suitable context for this study because many of them have experienced improvements in education and financial systems over recent decades. However, the economic outcomes of these improvements differ substantially across countries. Some middle-income economies have successfully transformed human capital into sustainable growth, while others continue to face structural and financial constraints. The study uses secondary data obtained from the World Development Indicators (WDI) database published by the World Bank. WDI is one of the most reliable and widely used international databases in economic and financial research. It provides consistent and comparable macroeconomic data across countries and time periods. The study utilizes annual data for middle-income countries over the selected study period. Panel data methodology is employed because panel data combines both cross-sectional and time-series dimensions, thereby increasing estimation efficiency and reducing omitted variable bias.

3. Methodology Model Specification

We in our study applied first Ordinary least square regression (OLS) to investigate the impact of human capital development index (HCI) and financial development (FD) and the interaction term of HCI and FD as HCIFD on economic growth. Then we applied structural equation modeling and mediation analysis (MEDSEM).

Structural equation modeling and mediation analysis helped us to investigate the direct and indirect impact of HCI on economic growth. The direct impact is the direct impact of HCI on economic growth and the indirect impact of HCI through the FD. For the robustness check we also applied fixed effect model and random effect model to investigate and control for the countries and year effects. For the variable definition see appendix table 6.

The Fixed Effects (FE) model controls for country-specific characteristics that remain constant over time. The FE model assumes that individual country effects may be correlated with explanatory variables. Wooldridge (2010) argued that FE estimation is appropriate when omitted country-specific factors influence the dependent variable. The Random Effects (RE) model assumes that country-specific effects are random and uncorrelated with explanatory variables. RE estimation is more efficient when this assumption holds. The Hausman test is used to determine whether the FE or RE model is more appropriate. Hausman (1978) argued that if explanatory variables are correlated with country-specific effects, the FE model should be preferred. The selected models are appropriate for several reasons. First, the model is theoretically grounded in Human Capital Theory and Financial Intermediation Theory. Human Capital Theory suggests that investment in education and skills enhances labor productivity and economic performance, while Financial Intermediation Theory explains how financial institutions facilitate productive investment and resource allocation. Second, the inclusion of the interaction term allows the study to examine the moderating role of financial development, which represents the central objective of the research. Previous studies often examined human capital and financial development independently; however, this study investigates how financial development influences the effectiveness of human capital in promoting economic growth. Third, the model includes important macroeconomic control variables such as inflation, trade openness, and FDI to reduce omitted variable bias. These variables are widely recognized

determinants of economic growth in empirical literature.

The panel data models are highly suitable for cross-country growth studies because they capture both country-specific and time-specific effects. Baltagi (2008) argued that panel data estimation improves efficiency and controls for unobserved heterogeneity across countries. The study employs panel data estimation techniques to examine the relationship between human capital, financial development, and economic growth in middle-income countries. Panel data combines cross-sectional and time-series observations. According to Hsiao (2007) panel data models provide several advantages, including increased variability, reduced multicollinearity, and improved estimation efficiency. Panel data analysis also controls for unobserved heterogeneity across countries.

4. Results and Discussion

4.1 Descriptive Statistics

Table 1 presents the descriptive statistics of the study variables. Economic growth, measured by GDP per capita (PPP), exhibits considerable variation across middle-income countries, with a mean value of 9,576.88 and a standard deviation of 6,510.36, indicating substantial differences in economic performance among the sampled countries. Human capital indicators also demonstrate notable variation. The Human Capital Development Index (HCD) has a mean value of 161.77, while the Human Capital Index (HCI) records a mean of 0.12. These variations suggest significant differences in educational attainment and human capital accumulation across middle-income economies. Financial development, measured by domestic credit to the private sector (% of GDP), has an average value of 28.09%, indicating moderate financial sector development within the sample countries. Trade openness averages 69.43%, reflecting a relatively high level of integration into global markets.

Table 2 reports the correlation matrix reveals a strong positive association between economic growth and human capital indicators. GDP per capita is positively correlated with HCD ($r = 0.69$) and HCI ($r = 0.59$), suggesting that countries with

better educational outcomes tend to achieve higher levels of economic performance. Financial development also exhibits a positive correlation with economic growth ($r = 0.34$), supporting the argument that efficient financial systems contribute to economic prosperity. Importantly, the correlations among explanatory variables remain below commonly accepted multicollinearity thresholds, indicating that multicollinearity is not a major concern in the study. See appendix for the descriptive statistics and correlation matrix.

4.2 Regression Analysis.

Table 3 reports regression results. Total 6 models were analyzing in the regression table. Model 1 reports the OLS regression without the interaction term while the model 2 include term to analyze and report the moderation effect of the financial development in the human capital and growth nexus. The results demonstrate a strong and statistically significant positive relationship between human capital and economic growth. In Model 1, the coefficient of HCI is 6876.34 ($p < 0.01$), indicating that improvements in human capital substantially enhance economic performance. The moderation effect which we investigated through the interaction is significant at 1% and is 48.76. HCIFD positive effects are observed across alternative specifications, confirming the robustness of the findings. Likewise, when the alternative human capital measure (HCD) is employed, the coefficient remains positive and highly significant ($\beta = 110.46$, $p < 0.01$).

Second, we used Structural Equation Modeling (SEM) and Mediation Analysis (MEDSEM) methodology to investigate and report the impact of human capital impact on economic growth through direct and indirect channel using financial development (FD) as moderator. The Structural Equation Modeling (SEM) and Mediation Analysis (MEDSEM) methodology results are reported in Table No. 4 and 5. The mediation analysis shows that under Delta test Sobel test Montecarlo test all are significant at 1% and their values are 514.91(0.00) 514.91(0.00) and 512.90(0.00) respectively showing string

significance. RIT is the ratio of Indirect to Total Effect which is calculated as $RIT = \text{Indirect Effect} / \text{Total Effect} = 514.914 / 7391.257 = 0.070$ and RID is the Ratio of Indirect to Direct Effect that is $RID = \text{Indirect} / \text{Direct Effect}$ and the value from our result is $514.914 / 6876.343 = 0.075$ this mean that there is Meaning that about 7 % of the effect of human capital development (HCI) on GDP is mediated by financial development(FD) and that the mediated effect is about 0.1 times as large as the direct effect of HCI on GDP. which show that there is moderation impact on financial development between human capital development. This mean there is partial moderating effect of FD on GDP and the effect of human capital development (HCI) on GDP is moderated by 7% by financial development which support our hypothesis we developed in our study. These

findings provide strong support for H1, which posits that human capital positively influences economic growth in middle-income countries. The results are consistent with Human Capital Theory proposed by Schultz and Becker, which argues that investments in education and skills enhance labor productivity and economic efficiency. The findings also support the Endogenous Growth Theory of Lucas (1988) and Romer (1990), which emphasizes the role of knowledge accumulation, innovation, and learning spillovers in sustaining long-run economic. growth. The results further align with empirical studies by Barro (2001) and Hanushek and Woessmann (2020), who documented the positive contribution of educational attainment and cognitive skills to economic performance. Our all result are robust.

Table No.3.

The regression tables report the results of 6 models we analyze to investigate impact of the moderating role of financial development in human capital development growth nexus. Models 1 to 3 and 6 we used OLS regression while models 4 is fixed effect and 5 is random effect model and model 6 we use OLS but control country and year. All models are significant at 1% which shows are strong impact from our explanatory variables FD and HCI Interaction term HCIFD o dependent variable GDP

	(1) GDP	(2) GDP	(3) GDP	(4) GDP(FE)	(5) GDP(RE) RE	(6) GDP
HCI	6876.34** *	5310.8***		4778.44***	4977.3***	
	(388.58)	(613.56)		(358.02)	(343.08)	
FD	61.92*** (6.98)	49.87*** (7.85)	37.51*** (14.4)	60.48*** (6.37)	58.47*** (6.16)	25.72* (14.12)
TRADE	11.2* (6.11)	11.53* (6.08)	-10.55 (12.6)	-10.65* (5.95)	-10.17* (5.69)	19.7* (10.35)
INFLATION	66.99*** (16.93)	70.15*** (16.87)	-4.89 (8.49)	-10.81 (9.39)	-7.28 (9.25)	.08 (3.04)
POPULATION	-362.63** (170.55)	-428.58** (170.83)	-573.18* (334.82)	-384.87*** (140.3)	-399.09*** (137.22)	-145.63 (194.73)
FDI	-52.95 (59.94)	-29.74 (60.04)	48.62 (74.94)	-56.53* (30.94)	-56.55* (30.78)	25.71 (26.37)
HCIFD		48.76*** (14.84)				
HDC			110.46*** (12.47)			44.42*** (14.51)
_CONS	6267.35**	6431.95***	-	9172.02***	9024.14***	3173.99*

	*		6232.17***			
	(542.59)	(542.02)	(2302.03)	(508.97)	(778.71)	(1895.82)
Observations	921	921	188	921	921	188
R-squared	.45	.46	.52	.41	-	.98
Country dummy						Yes
Year dummy						Yes

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

Table No. 4

(5943 observations with missing values excluded)

Endogenous variables

Observed: GDP FD

Exogenous variables

Observed: HCI TRADE INFLATION POPULATION FD

Fitting target model:


Iteration 0: log likelihood = -25813.121

Iteration 1: log likelihood = -25813.121

Structural equation model Number of obs = 921

Estimation method = ml

Log likelihood = -25813.121



	Coef.	Std.Err.	P>z	[95%Conf. Interval]
Structural				
GDP <				
FD	61.92	6.95	8.90	0.00 48.29 75.55
HCI	6876.34	387.10	17.76	0.00 6117.64 7635.05
TRADE	11.20	6.09	1.84	0.07 -0.73 23.14
INFLATION	66.99	16.87	3.97	0.00 33.94 100.05
POPULATION	-362.63	169.90	-2.13	0.03 -695.63 -29.64
FD	-52.95	59.71	-0.89	0.38 -169.98 64.08
_cons	6267.35	540.52	11.60	0.00 5207.95 7326.75
FD <				
HCI	8.32	1.81	4.58	0.00 4.76 11.87
TRADE	0.37	0.03	14.38	0.00 0.32 0.43
INFLATION	-0.43	0.08	-5.44	0.00 -0.58 -0.27
POPULATION	-0.31	0.81	-0.39	0.70 -1.89 1.27
FD	-1.33	0.28	-4.74	0.00 -1.87 -0.78
_cons	16.75	2.50	6.70	0.00 11.84 21.65
var(e.GDP)	2.76e+07	1288293	2.52e+07	3.03e+07
var(e.FD)	620.77	28.93	566.59	680.14

Note: The LR test of model vs. saturated is not reported because the fitted model is not full rank.

Table No. 5

Significance testing of indirect effect (unstandardized)

Estimates	Delta	Sobel	Monte	Carlo*
Indirect effect	514.91	514.91	514.91	512.90
Std. Err.	126.32	126.32	126.32	126.82
z-value	4.08	4.08	4.08	4.04
p-value	0.00	0.00	0.00	0.00
Conf. Interval	267.33 , 762.49	267.33 , 762.49	279.88 , 771.43	

*You typed in mcreps < #of obs, your mcreps is however set to #of obs!

Baron and Kenny approach to testing mediation

STEP 1 - FD:HCI (X -> M) with B=8.316 and p=0.000

STEP 2 - GDP:FD (M -> Y) with B=61.919 and p=0.000

STEP 3 - GDP:HCI (X -> Y) with B=6876.343 and p=0.000

As STEP 1, STEP 2 and STEP 3 as well as the Sobel's test above are significant the mediation is partial!

RIT = (Indirect effect / Total effect)

(514.914 / 7391.257) = 0.070

Meaning that about 7 % of the effect of HCI on GDP is mediated by FD!

RID = (Indirect effect / Direct effect)

(514.914 / 6876.343) = 0.075

That is, the mediated effect is about 0.1 times as large as the direct effect of HCI on GDP!

Note: to read more about this package help medsem

5. Conclusion, Summary and Policy Recommendations

5.1 Conclusion and Summary

This study examined the moderating role of financial development in the relationship between human capital and economic growth in middle-income countries. Drawing upon Human Capital Theory, Endogenous Growth Theory, and Financial Intermediation Theory, the study investigated whether financial development enhances the growth-promoting effect of human capital. Using panel data from middle-income

countries and applying Ordinary Least Squares (OLS), Fixed Effects (FE), Random Effects (RE), Structural Equation Modeling (SEM), and mediation analysis, the study provides comprehensive evidence regarding the interaction between human capital, financial development, and economic growth. The empirical findings reveal that human capital significantly and positively affects economic growth, confirming that investments in education, knowledge, and skills enhance productivity and contribute to long-run economic performance. This finding supports

Human Capital Theory and the endogenous growth literature, which emphasize the central role of education and knowledge accumulation in economic development. The results further indicate that financial development exerts a positive and significant effect on economic growth. The availability of financial resources through developed banking systems and financial institutions facilitates investment, entrepreneurship, and efficient allocation of resources, thereby stimulating economic activity. This finding is consistent with Financial Intermediation Theory and previous empirical studies highlighting the importance of financial sector development for economic prosperity. Most importantly, the study finds strong evidence that financial development positively moderates the relationship between human capital and economic growth. The positive and statistically significant interaction term between human capital and financial development demonstrates that the growth-enhancing effect of human capital becomes stronger in countries with more developed financial systems. This finding suggests that educated and skilled individuals can contribute more effectively to economic growth when supported by efficient financial institutions that provide access to credit, investment opportunities, and entrepreneurial financing. The mediation analysis provides additional insights into the relationship among the variables. The results reveal that financial development partially mediates the impact of human capital on economic growth, indicating that human capital contributes to economic growth both directly and indirectly through improvements in financial development. Although the direct effect of human capital remains dominant, the indirect effect through financial development is statistically significant, emphasizing the complementary nature of these two factors.

Overall, the findings suggest that human capital and financial development should not be viewed as independent drivers of economic growth. Rather, they operate as complementary and mutually reinforcing mechanisms that collectively promote economic development. Middle-income countries seeking sustainable growth should

therefore simultaneously strengthen educational systems and financial institutions to maximize the economic returns from human capital investments.

5.2 Policy Recommendations

Based on the empirical findings, several policy recommendations can be proposed for policymakers in middle-income countries. Strengthen Investment in Human Capital Development

Governments should continue to invest in education, vocational training, skill development, and healthcare systems. Improving the quality of education rather than merely increasing enrollment rates is essential for enhancing labor productivity, innovation capacity, and technological adaptability. Greater emphasis should be placed on science, technology, engineering, and mathematics (STEM) education, technical training, and digital skills development to prepare the workforce for knowledge-based economies.

Policymakers should implement reforms aimed at improving the efficiency, accessibility, and stability of financial institutions. Expanding private sector credit, strengthening banking systems, improving financial regulation, and encouraging competition within the financial sector can facilitate productive investment and economic growth. A well-developed financial system enables individuals and firms to utilize human capital more effectively. Financial inclusion policies should be prioritized to ensure that households, entrepreneurs, and small and medium-sized enterprises (SMEs) have access to financial services. Expanding access to affordable credit, digital banking services, and microfinance programs can reduce financial constraints and enable educated individuals to engage in productive entrepreneurial activities.

The findings indicate that education policies and financial sector policies should be designed in a complementary manner. Governments should create policy frameworks that link educational development with entrepreneurship financing, innovation funding, and business incubation programs. Such integration would maximize the economic returns from investments in human capital. Middle-income countries should

encourage innovation-driven growth through increased support for research and development (R&D), technological adoption, and knowledge-intensive industries. Financial institutions should be encouraged to provide financing for innovative enterprises, start-ups, and technology-based businesses that utilize highly skilled human resources.

The effectiveness of both human capital and financial development depends on strong institutions. Policymakers should strengthen governance quality, regulatory effectiveness, transparency, and rule of law to improve the efficiency of financial markets and educational investments. Better institutions enhance investor confidence and facilitate productive utilization of human capital.

5.3 Limitations and Future Research Directions

Despite providing important insights, this study has several limitations. First, the analysis focuses exclusively on middle-income countries, which may limit the generalizability of the findings to low-income or high-income economies. Second, financial development is measured using domestic credit to the private sector, while other dimensions of financial development such as stock market development, financial inclusion, and financial efficiency are not examined. Third, human capital is primarily measured using educational and government spending on education indicators and may not fully capture qualitative aspects of education and skills.

Future research may extend the analysis by incorporating alternative measures of financial development, institutional quality, technological innovation, and governance indicators. Researchers may also investigate potential nonlinear effects and threshold levels of financial development in the human capital-growth relationship. Furthermore, comparative studies across income groups and regional economies could provide additional insights into how financial development influences the effectiveness of human capital under different economic conditions.

In conclusion, the study demonstrates that financial development plays a critical role in

enhancing the contribution of human capital to economic growth. Sustainable economic development in middle-income countries requires not only investment in education and skills but also the development of efficient financial systems capable of transforming human capital into productive economic outcomes. Therefore, coordinated policies aimed at strengthening both human capital and financial development are essential for achieving long-term economic growth and prosperity.

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