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POPULATION, EDUCATION AND MAQAṢID-BASED HUMAN DEVELOPMENT IN INDONESIA: EVIDENCE FROM PROVINCIAL PANEL DATA WITH ECONOMIC GROWTH MODERATION (2016–2023)

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Abstract

This study seeks to ascertain the extent to which economic growth can directly and indirectly influence the Human Development Index (HDI), as well as the roles of population and education in this context. The findings indicate that both population and education significantly contribute to the Human Development Index (HDI), as evidenced by the test results. While moderating interactions do not exert a significant influence, they do not alter the relationship between population and education concerning the Human Development Index (HDI). The conclusion underscores the necessity of balancing population growth with enhancements in educational quality to foster a positive shift in the Human Development Index (HDI), which, in turn, will impact economic growth both directly and indirectly.

Keywords: Human Development Index, Economic Advancement, Demographics, Education

INTRODUCTION

Indonesia's human development indicators currently reflect progress, although several structural challenges persist. In 2024, Indonesia's Human Development Index (HDI) is projected to reach 75.02, indicating a more rapid increase than observed during the 2020-2023 period. This growth is chiefly attributed to enhancements in living standards, adjusted real per capita expenditure, and advancements in knowledge (Statistics Indonesia, 2025). These indicators, along with numerous accomplishments, reflect the ongoing upward trajectory of the Human Development Index (HDI). Overall, the equilibrium of human quality is highly responsive to the perspectives of macroeconomics, microeconomics and the quality of education across various levels.

Demographically, Indonesia's population is projected to reach 284.44 million by mid-2025, indicating both growing potential and challenges. The transition from quantity to quality enhances development by expanding access and elevating the standards of education and healthcare across various regions (Mulyanto et al., 2020). The inability to enhance governance in public services adversely affects population metrics, including the Human Development Index (HDI). Control can be exercised through constraints on social infrastructure and services, particularly in regions experiencing relatively swift population growth (Putri et al., 2022).

In 2022, identified fundamental competency deficits and elevated levels of learning poverty reveal challenges to the instructional core, including teacher-student relationships and content, which impede the transformation of accumulated years of schooling into productive human capital (OECD, 2022). Systematically, issues such as these are linked to the disparity in teacher quality, the lack of consistent formative assessment practices, and a curriculum that has yet to meet the diverse needs of various aspects (Aman, 2021). Enhancing the quality of education necessitates genuine interventions, such as fortifying pedagogical approaches, ensuring teachers master their subject matter through the application of differentiated instruction (teaching at the appropriate level), implementing ongoing formative assessments, and providing affirmative funding for underprivileged (Gugus et al., 2024). This collaboration is enhanced by the fortification of vocational education, aligning and integrating it with the labor market and competency certification, ensuring that the skills developed possess economic value. Consequently, the enhancement of learning quality not only elevates academic performance but also reinforces the connection between education and real per capita income productivity, ultimately expediting the Human Development Index

(HDI) (Foster & Kingdom, 2024).

Macroeconomics from Indonesia's perspective reveals an economy that has experienced substantial transformations, with the Gross Domestic Product (GDP) projected to grow by 5.03% in 2024. This growth is followed by a decline to 4.87% (year-over-year) in the first quarter of 2025, before rebounding to 5.12% in the second quarter of 2025 (Badan Pusat Statistik, 2025). This order is significant as it serves as the primary transition channel for enhancing the standard of living dimension within the Human Development Index (HDI) by increasing real income per capita, broadening fiscal capacity for education and health services, and expanding quality employment opportunities (Suparman & Muzakir, 2023). When the economy undergoes growth and market scale expands, agglomeration and the accumulation of human capital become more effective in enhancing the Human Development Index (HDI). Conversely, when growth diminishes, these transitional mechanisms weaken, thereby diminishing the impact of population and education on the HDI (Liana et al., 2024).

This study aims to investigate the extent and conditions under which economic growth moderates the relationship between population, education, and the Human Development Index (HDI) in Indonesia, given the aforementioned issues. In this context, the study employs human capital theory, which identifies investment, education, and health as key drivers of productivity and income. Aggregate Population and Educational Attainment are structural determinants that capture demographic pressure and human capacity in explaining HDI disparities across Indonesian provinces. From an Islamic economics perspective, population reflects challenges in managing *maslahah*, while education strengthens intellectual capacity (*ḥifẓ al-ʿaql*), making both variables central to Islamic human development. This study contributes to the literature by examining the conditional role of economic growth using a fixed effects panel model (2016–2023). The findings show that economic growth does not significantly moderate these relationships, suggesting that growth alone is insufficient to enhance human development outcomes, a result that advances welfare-oriented discussions in Islamic economics.

Demographic perspectives on managing scale and age structure, alongside macroeconomic transition mechanisms through real per capita income, fiscal capacity, and employment, connect growth to human development outcomes. This study empirically contributes by delineating the heterogeneity of the impact of population and education on the Human Development Index (HDI) across various regions and time periods, while also assessing the strength of the moderating effect of growth, which is pertinent for policy formulation. Consequently, the findings are anticipated to offer operational implications for both central and regional governments to harmonize population governance, enhance the quality of basic and secondary education, and fortify inclusive growth engines, thereby ensuring that the acceleration of the Human Development Index is more rapid, equitable, and sustainable.

LITERATURE REVIEW

Capability Approach Theory

From a theoretical standpoint, this study integrates two primary frameworks. The capability approach perceives development as the enhancement of genuine human freedom to lead a healthy, informed life and attain a respectable standard of living. (Barreno-Alcalde et al., 2024). These three components of the Human Development Index (HDI) within human capital theory underscore that education and health are investments that enhance productivity and well-being. The HDI is perceived not merely as a consequence of increasing incomes, but as a reflection of the enhanced capabilities and genuine opportunities accessible to citizens (Psacharopoulos & Patrinos, 2018).

Capability Approach Theory: Human Development Index

The Human Development Index (HDI) encapsulates the aggregation of fundamental human capabilities, assessed through health, as indicated by life expectancy, education, and standard of living. The capability approach to enhancing the Human Development Index (HDI) emphasizes not only the monitoring of income growth but also the outcomes of public and private investments that broaden access to and improve the quality of health services, education, and welfare support. From an endogenous growth perspective, the quality of human capital represents a lasting transformation in the accumulation of knowledge, technology adoption, and productivity. Consequently, the Human Development Index serves as

both a critical determinant and a reflection of developmental outcomes. Operationally, the Human Development Index (HDI) is derived from three dimensions: health (life expectancy at birth), education (expected years of schooling and average years of schooling), and standard of living (real per capita income) (Beck et al., 2022).

Capability Approach Theory: Population Size Versus Human Development Index

Population growth is evident in the demographic transition, which signifies a change in age structure from a high dependency ratio to a demographic bonus, thereby creating opportunities to enhance the Human Development Index (HDI) through increased productivity and labor force participation. However, the viewpoint regarding public service capacity and congestion externalities underscores that unbalanced population growth, lacking the expansion of social infrastructure (education and health) and effective governance, may undermine these beneficial effects (Safira et al., 2024). Thus, the impact of population on the Human Development Index (HDI) is conditional, potentially positive through the expansion of market scale and agglomeration externalities. However, it may also be negative when per capita service capacity diminishes, the dependency ratio rises, and spatial inequality in access to essential services emerges. The extent of these effects is primarily influenced by institutional fiscal capacity and the market's capacity to accommodate population growth.

Capability Approach Theory: Education and the Human Development Index

Human capital theory characterizes education as an investment aimed at enhancing productivity, securing quality employment opportunities, and increasing income. These effects manifest through two dimensions: quantity (years of schooling) and quality (cognitive and noncognitive competencies). Consistent with the theory of returns to schooling, advancements in learning quality, curriculum relevance, and alignment with labor market demands bolster education's role in the knowledge dimension of the Human Development Index (HDI) and, via the income channel, contribute to improved living standards (Angrist et al., 2021). In accordance with the human capital framework, the literature on learning effectiveness indicates that robust pedagogical practices, including continuous formative assessment and differentiated instruction, can convert educational inputs into significant learning outcomes. At the aggregate level, these outcomes contribute to enhancing the knowledge dimension of the Human Development Index (HDI) and, through the income channel, elevate living standards (Horie & Iwasaki, 2023).

Capability Approach Theory: Economic Development

Economic growth serves as a moderator that influences both the strength and direction of the effects of education and population on the Human Development Index (HDI). Methodologically, a moderator is a variable that alters the slope of the causal relationship, indicating that the impact of education and population on the HDI is contingent upon the growth context. This perspective is consistent with human capital theory and the capability approach, which assert that development outcomes are shaped not only by sectoral inputs but also by macroeconomic dynamics that affect the capacity of households and the state to deliver essential services (Clement & Bradley-Garcia, 2022).

Mechanistically, growth functions through three interrelated channels: the income channel (increased per capita output enhances purchasing power for health and education), the fiscal channel (expanding the tax base creates opportunities for productive social spending), and the labor market channel (growth in formal employment boosts productivity, income security, and social protection). The moderating effect is typically more pronounced when growth is inclusive and bolstered by robust institutional capacity, as evidenced by the expansion of coverage and enhancement of the quality of public services, along with effective management of demographic challenges. Conversely, during economic slowdowns or when growth is concentrated within a limited segment, the three transmission channels income, fiscal and labor market diminish, leading to a reduced contribution of education to the Human Development Index (HDI) and heightened demographic pressures. Additionally, the consideration of specific minimum thresholds (nonlinearity) and interregional disparities in the tax base, economic structure, and service costs is essential when evaluating the strength of moderation (Chakroun Mohamed, 2024).

RESEARCH METHODS

This study employs a quantitative methodology to investigate the extent to which economic growth moderates the impacts of population and education on the Human Development Index (HDI). The study population consisted of all 38 provinces in Indonesia as of 2025. Purposive sampling was utilized to select 19 provinces throughout Indonesia for the period from 2016 to 2023. The selection is based on three main criteria.First, the included provinces have completed and consistent data availability for all study variables Human Development Index (HDI), population, educational attainment, and Gross Regional Domestic Product (GRDP) for the entire observation period, allowing the construction of a balanced panel dataset. Second, the selected provinces exhibit administrative and territorial stability throughout the study period, thereby minimizing potential breaks in data series that could affect estimation validity. Third, the sample ensures regional representation across western, central, and eastern Indonesia to capture spatial variation in development outcomes. We also clarify that presenting the full dataset for all selected provinces is intended to enhance methodological transparency and research replicability, while avoiding potential concerns of selection bias. This approach is consistent with the logic of the Fixed Effects Model (FEM), which relies on within-province variation. The analytical method employed in this study is panel data regression, utilizing the Fixed Effect Model (FEM) approach, facilitated by the Econometric Views 13 (Eviews 13) software, as demonstrated in the following analytical equation:

$$IPMCiy = c0 + c1JPCiy + c2TPSiy + c3JPCiy* PDRBiy + C4TPSiy* PDRBiy + eiy$$

Information:
IPMCiy = Human Development Index (Y)
JPCiy = Aggregate Population (X1)
TPSiy = Educational Attainment (X2)
GDP = Economic Expansion (Z)
JPC, TPS = Coefficient of influence of IPMC and JPC on IPMC
JPC, TPS, IPM = Coefficient of influence of IPMC, JPC, and IPMC on GRDP
c0 = constant
cb = regression coefficient
eiy = error coefficient

With the subsequent Model and Hypothesis:

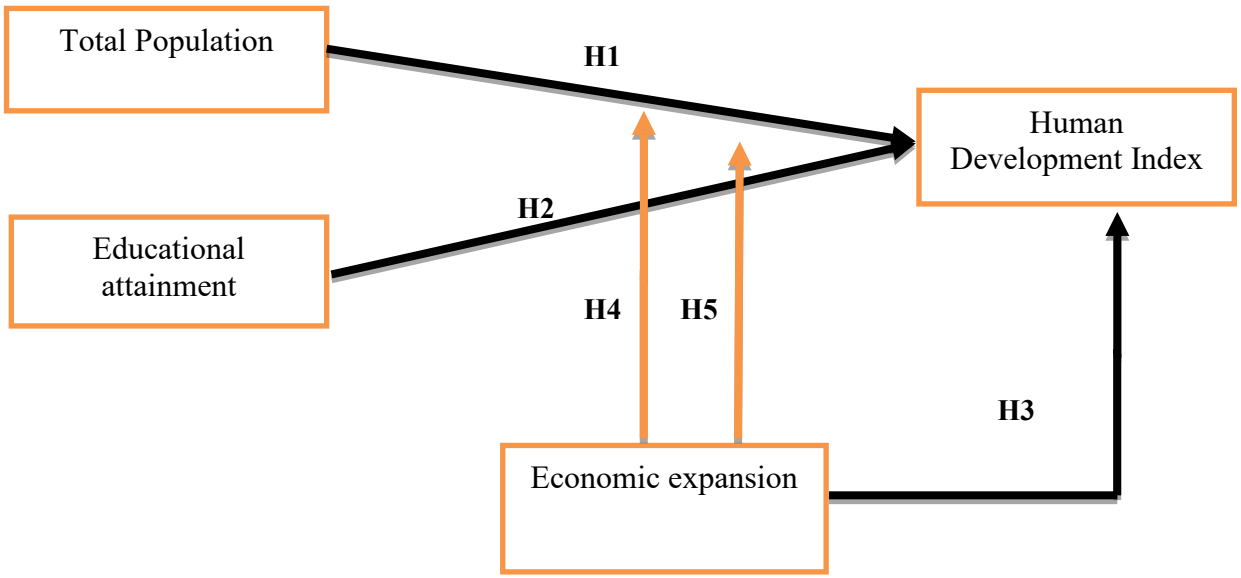

Figure 1. Conceptual Framework Model

Hypothesis
H1: Population positively influences the Human Development Index
H2: The level of education positively influences the Human Development Index
H3: Economic Growth Positively Influences the Human Development Index
H4: Economic Growth can influence Population Size on the Human Development Index
H5: The level of education can moderate the impact of economic growth on the Human Development Index

RESULTS AND DISCUSSION

To perform panel data regression, three models may be utilized: the Common Effect Model (CEM), the Fixed Effect Model (FEM), and the Random Effect Model (REM). The Chow test serves as the initial indicator test conducted prior to selecting the suitable model between the Common Effect Model (CEM) and the Fixed Effect Model (FEM).

Table 1. Outcomes of the Chow Test Model

Effects Test	Statistic	d.f.	Prob.
Cross-section F	26.549640	(18,130)	0.0000

The Chow test results presented in Table 1 indicate a Prob. value of 0.0000, which is less than 0.05, signifying that the optimal model selected is the FEM model. Subsequently, the Hausman test procedures are designed to ascertain whether the FEM or REM is the suitable model.

Table 2. Outcomes of the Hausman Test Model

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	33.151973	3	0.0000

The results presented in Table 2 indicate the Hausman test, which yields a probability value of 0.0000, less than 0.05. Consequently, the decision regarding the appropriate model, based on the Chow and Hausman tests conducted, is that the Fixed Effect Model (FEM) is the most suitable choice. Given the consistent outcomes from both the Chow and Hausman tests, the FEM model is affirmed as the optimal selection. Therefore, it can be concluded that the Lagrange Multiplier (LM) test is unnecessary, reinforcing that the model employed in this study is the Fixed Effect Model (FEM).

Table 3 Outcomes of the FEM Regression Model for Equation I

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-15.72638	7.662568	-2.052364	0.0421
Population	0.001029	0.000315	3.263039	0.0014
Education	5.814799	0.686482	8.470437	0.0000
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.941043	Mean dependent var		71.31822

Adjusted R-squared	0.932042	S.D. dependent var	4.362994
S.E. of regression	1.137380	Akaike info criterion	3.222965
Sum squared resid	169.4661	Schwarz criterion	3.640738
Log likelihood	-223.9453	Hannan-Quinn criter.	3.392679
F-statistic	104.5476	Durbin-Watson stat	1.005012
Prob(F-statistic)	0.000000		

The results obtained from testing the FEM regression model of equation I, as presented in Table 3, can be summarized as follows:

1. The results of the FEM regression model test on the statistical figures of the population variable indicate a value of 3.263039, accompanied by a probability value of 0.0014, which is less than 0.05. This demonstrates that the population variable significantly influences the human development index in Indonesia
2. The results of the FEM regression model test regarding the statistical figures of the education level variable indicate a value of 8.470437, accompanied by a probability value of 0.0000, which is less than 0.05. This demonstrates that the education level variable significantly influences the human development index in Indonesia.
3. The Adjusted R Square value of 0.932042 indicates that the combined impact of the population and education level variables on the human development index accounts for 93.2%.

Table 4 Results of the Finite Element Method Regression Model of Equation II

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13.70212	9.276027	-1.477154	0.1421
Population	0.001044	0.000319	3.275747	0.0014
Education	5.632497	0.832396	6.766609	0.0000
PDRB	3.42E-06	8.76E-06	0.389951	0.6972

Effects Specification			
Cross-section fixed (dummy variables)			
R-squared	0.941112	Mean dependentvar	71.31822
Adjusted Rsquared	0.931599	S.D. dependent var	4.362994
S.E. of regression	1.141079	Akaike info criterion	3.234954
Sum squared resid	169.2681	Schwarz criterion	3.672621

The M (Moderation) variable of economic growth exhibits a t-Statistic value of 0.389951 with a Prob. value of 0.6972 (>0.05), indicating that the economic growth variable does not significantly influence the human development index in Indonesia. Furthermore, the Adjusted R Square value of 0.995159 suggests that the combined contributions of the population, education level, and GRDP variables account for 93.1% of the variance in the human development index in Indonesia.

Table 5. Outcomes of the FEM Regression Model for Equation III

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-22.99066	11.70137	-1.964783	0.0516
Population	0.001385	0.000451	3.071968	0.0026
Education	6.045442	1.036127	5.834651	0.0000
GRDP	0.000234	0.000174	1.341814	0.1820
Population "Z"	-1.44E-09	1.22E-09	-1.183102	0.2390
Education "Z"	-1.61E-05	1.29E-05	-1.252246	0.2128
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.942910	Mean dependent var		71.31822
Adjusted R-squared	0.932652	S.D. dependent var		4.362994
S.E. of regression	1.132263	Akaike info criterion		3.230253
Sum squared resid	164.0986	Schwarz criterion		3.707708
Log likelihood	-221.4992	Hannan-Quinn criter.		3.424212
F-statistic	91.91660	Durbin-Watson stat		0.993892
Prob(F-statistic)	0.000000			

The outcomes derived from the evaluation of the FEM regression model outlined in equation III, as illustrated in Table 5, can be summarized as follows:

1. The results of the FEM regression model test on the statistical figures of the population variable reveal a value of -1.183102, with a probability value of 0.2390, which surpasses 0.05. This outcome indicates that the economic growth variable does not significantly moderate the population variable concerning the human development index in Indonesia.
2. The results of the FEM regression model test concerning the statistical figures of the education level variable reveal a value of -1.252246, accompanied by a probability value of 0.2128, which exceeds 0.05. This outcome indicates that the economic growth variable does not significantly moderate the education level variable in relation to the human development index in Indonesia
3. The Adjusted R Square value of 0.932652 signifies that the collective impact of the variable's population, education level, population "Z" population level "Z" and GRDP 'M' explains 99.5% of the variance in the Human Growth Index variable.

With the introduction of the moderating variable, economic growth affected the independent variables of population size and education level in relation to the dependent variable of the human development index, demonstrating a magnitude of 93.1% both prior to and following the inclusion of the moderating variable.

DISCUSSION

The Impact of Population on the Human Development Index (HDI) in Indonesia

This study demonstrates that the population level variable is at 0.0014, accompanied by a positive coefficient value of 0.001029. This probability is less than the α level of 5%. These findings suggest that population size significantly influences the human development index. The identification of a positive and significant coefficient for population size on the HDI is consistent with the capability approach of human capital theory and the demographic transition. When public services and the labor market are sufficient, a larger population can lower education and health costs, enhance agglomeration, and generate additional employment opportunities. Consequently, human capital and income rise, as evidenced by the increase in the HDI (Damara & Handoyo, 2023).

This finding aligns with the research of Hasyim & Junaidi (2023), Siagian et al. (2024), Khairunnisa et al. (2023), Damara & Handoyo (2023), and Acar & Topdağ (2022). The scale of population density and urbanization, as a proxy, tends to promote human development achievements through three primary channels: First, a reduction in the average cost of providing health education services (economies of scale); Second, the deepening of the labor market and agglomeration externalities that enhance human capital accumulation; and third, an expanded fiscal base to finance essential services. Evidence from Indonesian subnational regions indicates a positive and significant relationship between population density and the Human Development Index (HDI) in Lampung, Central Java, and North Sumatra.

The Impact of Educational Attainment on the Human Development Index (HDI) in Indonesia

This study demonstrates that the population-level variable is at 0.0000, accompanied by a positive coefficient value of 5.632497. This probability is less than the α level of 5%. These results suggest that education level significantly influences the human growth index. This finding is consistent with human capital theory (Becker), which regards education as a productivity-enhancing investment; the capability approach (Sen), which promotes agency and health literacy; and endogenous growth theory (Lucas/Romer), which emphasizes knowledge and innovation spillovers (Robeyns, 2005).

Avalueva et al. (2022), Sijabat (2022), Ann et al. (2023), and Moga Rogoz et al. (2022) contend that education enhances the Human Development Index (HDI) through two primary approaches. The first is the economic approach, which posits that both cognitive and non-cognitive skills can elevate productivity, expand employment opportunities, and increase income. The second, the health and education approach, promotes healthy lifestyles, bolsters health literacy, and broadens access to services, thereby reducing mortality rates and extending life expectancy. At the macroeconomic level, investment in education initiates a "virtuous cycle" of human development, yielding improved outcomes such as enhanced health, strengthened economic growth, increased investment opportunities, and further advancements in HDI. Empirical evidence also indicates that the health benefits of education are more pronounced in countries with higher HDI, suggesting a positive correlation between education and levels of development.

The Impact of Economic Growth on the Human Development Index (HDI) in Indonesia

This study reveals that the population-level variable stands at 0.6972, accompanied by a positive coefficient value of 0.389951. This probability exceeds the α level of 5%. These findings suggest that economic growth significantly impacts the human development index. This aligns with the endogenous growth theory (Lucas/Romer), which positions economic growth as a catalyst for human capital accumulation, and the capability approach, which regards higher incomes as a means to enhance access to education and health (Lucas, Robert, 1988). The literature on the virtuous cycle of human development growth (Ranis & Stewart) further underscores the transmission channels through household income, government fiscal capacity (funding of essential services), and labor market expansion (Suri et al., 2011).

Ogujiuba et al. (2024), Giyasova et al. (2025), Li et al. (2023), and Moga Rogoz et al. (2022) collectively affirm a positive correlation between economic growth, as indicated by GDP/GNI per capita, and human development (HDI). This relationship is facilitated through two primary channels: the enhancement of household income, which increases consumption capacity, and the investment in education and health, which bolsters governmental fiscal capacity to fund essential services and social infrastructure. The effect is generally more pronounced in low- to middle-income countries and regions, particularly when growth is inclusive and underpinned by infrastructure investment and effective governance.

The Impact of Economic Growth on Population Size and the Human Development Index in Indonesia

This study reveals that the population variable has a value of -1.183102, accompanied by a probability value of 0.2390, which exceeds the threshold of 0.05. This indicates that the probability figure surpasses the α = 5% level. Consequently, these findings suggest that economic growth does not significantly moderate the population variable concerning the human growth index. This aligns with the capability approach and human capital theory (Becker), which assert that growth enhances the HDI only when it translates into access to quality education and healthcare. Within the framework of the demographic dividend, the impact of a growing population is advantageous only if the labor market can absorb the

workforce and if investments in human quality are sufficient. Conversely, if the quality of growth is inadequate (non-inclusive and capital-intensive), the potential of growth to alleviate population pressure diminishes.

Managi et al. (2024), Wang et al. (2025), and Hassanein et al. (2024) have all affirmed that economic growth does not inherently result in an increase in the Human Development Index (HDI). The transformation of income into educational and health outcomes is predominantly influenced by the quality of governance, the composition of investments, fiscal capacity, and the availability of infrastructure. In scenarios characterized by high demographic pressure, the effect of growth on human development often diminishes or may even become negligible if not supported by inclusive policies and the enhancement of basic services.

The Impact of Economic Growth on the Moderation of Education Levels in the Human Development Index in Indonesia

This study reveals that the education level variable has a coefficient of -1.252246, accompanied by a probability value of 0.2128, which exceeds the threshold of 0.05. This probability surpasses the α level of 5%. These findings suggest that economic growth does not significantly moderate the education level variable in relation to the human growth index. Theoretically, this outcome aligns with the capability approach, which underscores the necessity of conversion factors to transform income into access and quality of services. Human capital theory posits that the returns on education are contingent upon the labor market's absorption capacity and the growth structure. It also corroborates endogenous growth theory, which necessitates complementary investments and effective institutions to facilitate knowledge spillovers. Therefore, the prevalence of capital-intensive growth, skill mismatches, or insufficient learning quality may obstruct the translation of education into enhancements in health and living standards, resulting in a lack of statistically identifiable moderating effects.

Stylianou et al. (2024) and Jin & Jakovljevic (2023) demonstrate that mere increases in income or growth are insufficient. The influence of education on the Human Development Index (HDI) hinges on the system's capacity to transform income into tangible services via effective governance, sufficient fiscal resources, and the quality and accessibility of infrastructure. Consequently, the moderating effect of growth on education frequently remains obscured when these conversion mechanisms are weak or non-inclusive.

CONCLUSION

This study employs a fixed effects model, utilizing the Chow and Hausman tests. The two primary variables, population and education demonstrate a positive and significant impact on the human development index. Conversely, the effect of economic growth and its interaction (X1Z, X2Z) is insignificant, thereby not altering the relationship between population size, education level, and the human development index. The model accounts for approximately 93% of the variation in the human development index, indicating that increased economic growth does not yield a positive effect. Consequently, by concentrating on population size and education level, the moderating role of economic growth remains unclear within this dataset.

SUGGESTION

Future research could enhance the findings by broadening the provinces, increasing the duration of study, and employing more precise metrics (learning quality, dependency ratio, urbanization, real income/consumption). Additionally, it could examine pertinent moderators (inequality, governance quality, labor market formality, and the capacity of growth to absorb labor).

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