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The Moderating Effect of Human Capital in the Investment-Growth Nexus: Evidence from MSME and Fixed Capital Formation in Indonesia

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Abstract

This study examines the short-run effects of Micro, Small, and Medium Enterprise (MSME) investment and Gross Fixed Capital Formation (*Pembentukan Modal Tetap Bruto*/PMTB) on inclusive economic growth in Indonesia, with human capital incorporated as a moderating variable. Using annual time-series data from 1990 to 2024 sourced from the World Bank, the analysis applies Moderated Regression Analysis (MRA) with model refinement through heteroskedasticity-robust standard errors and mean-centering to address multicollinearity. The empirical results demonstrate that MSME investment and human capital exert strong and significant positive impacts on inclusive growth, whereas PMTB shows a positive but relatively weak direct effect. Importantly, human capital significantly amplifies the influence of both MSME investment and PMTB on inclusive economic growth, confirming its catalytic role in enhancing the productivity and inclusiveness of investment. This study contributes new empirical evidence on the moderating function of human capital within Indonesia's investment–growth nexus by employing a rigorously corrected MRA framework on long-span time-series data, a methodological approach still limited in the existing literature.

Keywords

Gross Fixed Capital Formation, Human Capital, Inclusive Economic Growth, Moderated Regression Analysis, MSME Investment.

1. Introduction

Inclusive economic growth has increasingly become a central focus of Indonesia's development agenda, reflecting the need to ensure that economic expansion is accompanied by broad-based participation and equitable distribution of welfare gains. Rather than emphasizing output growth alone, the concept underscores the importance of opportunity equality, labor absorption, and regional balance in the development process (Anand et al., 2013). This framework is particularly relevant for Indonesia, where Micro, Small, and Medium Enterprises (MSMEs) account for more than 61% of GDP and employ around 97% of the national workforce, making them a primary engine of inclusive growth (Kemenkop UKM, 2023).

Despite their central role, the ability of MSMEs to drive inclusive economic outcomes remains constrained by persistent structural limitations. Key challenges include restricted access to capital, limited financial and managerial literacy, and uneven technological adoption, which impede productivity enhancement and long-term competitiveness (Rahmawati & Hapsari, 2022). Similar constraints appear in the performance of Gross Fixed Capital Formation (*Pembentukan Modal Tetap Bruto*/PMTB), a key indicator of physical investment. Although PMTB contributes to the expansion of productive capacity, its capacity to generate inclusive growth has been hindered by interregional productivity gaps and substantial variation in local labor quality (OECD, 2022).

Against this backdrop, endogenous growth theory provides a relevant analytical foundation. Seminal contributions by Lucas (1988) and Romer (1990) highlight the pivotal role of human capital in shaping the productivity of investment and sustaining long-run economic growth. Human capital through education, skills formation, and knowledge accumulation enhances a workforce's capacity to absorb new technologies, adapt to structural changes, and generate innovation-driven gains. In Indonesia, however, persistent disparities in Human Development Index (HDI) across provinces continue to affect investment efficiency and deepen regional inequality, limiting the potential for inclusive growth (BPS, 2023).

Given these dynamics, understanding how human capital interacts with MSME investment and PMTB is essential for assessing the drivers of inclusive economic growth. Yet, empirical studies exploring the moderating role of human capital within Indonesia's investment–growth nexus remain limited, particularly those utilizing long-span time-series data with robust econometric corrections (Nugroho & Ramli, 2021). This study addresses this gap by analyzing the direct and moderating effects of MSME investment, PMTB, and human capital on inclusive economic growth in Indonesia from 1990 to 2024 using a Moderated Regression Analysis (MRA) framework. The findings offer insights relevant for designing integrated policies to enhance investment effectiveness and promote inclusive development.

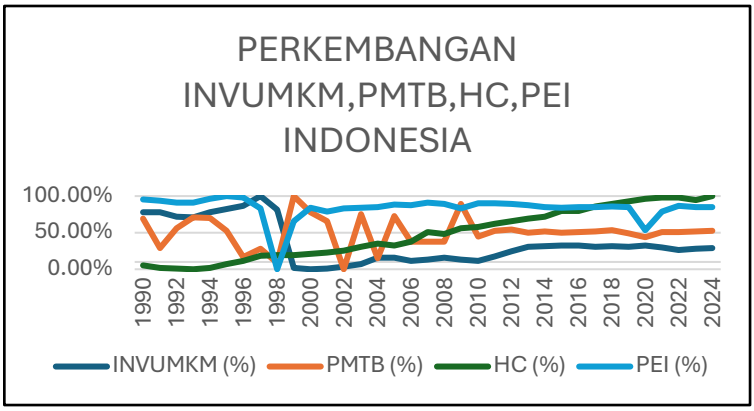

Figure 1. Development of MSME, PMTB, HC, and IGF Indonesia

Based on Figure 1, in the early 1990s, MSME investment (*Investasi Usaha Mikro, Kecil, dan Menengah*/INVUMKM) and PMTB were relatively stable but experienced a sharp decline and high volatility during the 1997–1998 Asian Financial Crisis due to disruptions to the credit system and contraction of physical capital (World Bank, 2022). In contrast, Human Capital (HC) continued to increase gradually, demonstrating the resilience of the education sector and demographic improvements. Inclusive growth factor (IGF) experienced a significant decline before recovering at the end of the decade. Entering the early 2000s, MSME investment and PMTB began to recover, although they remained fluctuating due to economic reforms and global shocks, including the 2008 financial crisis. Human capital continued to increase and strengthen productivity, while inclusive economic growth stabilized again, although it remained sensitive to global conditions.

From 2011 onward, investment dynamics became more stable, with INVUMKM showing improvements supported by financial inclusion and MSME credit programs, while PMTB remained moderate but less volatile than in earlier periods (Rahmawati & Hapsari, 2022). Human capital continued its strong and uninterrupted upward trend, reaching the highest levels in the observed series. PEI displayed greater stability, indicating stronger macroeconomic fundamentals, until the temporary downturn caused by the COVID-19 pandemic in 2020. The post-pandemic years show renewed recovery in both growth and investment. Across this period, rising human capital increasingly acted as a stabilizing and productivity-enhancing force for inclusive economic growth. Thus, the objective of this study is to analyze the influence of MSME investment and gross fixed capital formation on inclusive economic growth in Indonesia, as well as to examine the role of human capital in moderating the relationship between these two types of investment and inclusive economic growth during the period 1990–2024.

2. Literature Review

2.1. The Effect of MSME Investment on Inclusive Economic Growth

Micro, Small, and Medium Enterprises (MSMEs) play a strategic role in promoting inclusive economic growth due to their capacity to generate employment, expand entrepreneurial opportunities, and distribute income more evenly across regions. Recent studies emphasize that investment in the MSME sector contributes not only to output expansion but also to social and economic inclusion. Hossain (2023) finds that MSME financing expansion in developing economies significantly increases employment absorption and reduces income inequality. In the Indonesian context, Siregar et al. (2022) demonstrate that MSME investment positively affects regional economic growth and narrows interregional disparities.

From an endogenous growth perspective, Aghion et al. (2019) argue that decentralized investment in small and medium productive sectors stimulates innovation and long-term growth. Inclusive growth theory further highlights that economic development is considered high quality when economic opportunities are accessible to broader segments of society (Klasen, 2019). Nugroho and Ramli (2021) provide empirical evidence that MSME credit expansion and financial inclusion contribute to more equitable economic growth in Southeast Asia. In addition, modern financial intermediation theory suggests that MSME investment helps reduce market imperfections and improve the efficiency of resource allocation (Beck & de la Torre, 2019). Therefore, MSME investment is expected to exert a positive and significant influence on inclusive economic growth.

H1: MSME investment has a positive effect on inclusive economic growth.

2.2. The Effect of Gross Fixed Capital Formation on Inclusive Economic Growth

Gross Fixed Capital Formation (*Pembentukan Modal Tetap Bruto*/PMTB) represents investment in physical assets such as infrastructure, machinery, and production equipment that form the foundation of long-term economic growth. Recent literature confirms that physical capital accumulation plays a crucial role in expanding production capacity and enhancing economic connectivity. The World Bank (2022) emphasizes that well-distributed infrastructure development reduces regional disparities and improves market access for marginalized communities. Al Mamun et al. (2021) also find that increased PMTB contributes positively to economic growth in developing countries.

The updated neoclassical growth theory proposed by Barro and Sala-*i*-Martin (2020) explains that physical capital accumulation enhances labor productivity and per capita output. Structural transformation theory further suggests that physical investment facilitates the transition of economies toward higher value-added activities (Fagerberg & Srholec, 2021). However, Pallarés-Miralles et al. (2020) argue

that the inclusiveness of PMTB depends heavily on how investment benefits are distributed across regions and population groups.

Recent empirical studies indicate that the impact of PMTB on inclusive growth is conditional. Perugini and Signorelli (2021) highlight that physical capital yields stronger inclusive outcomes when complemented by adequate human capital and institutional quality. Similarly, Amiri and Akbari (2022) show that infrastructure investment becomes more inclusive when supported by appropriate policy frameworks. Thus, PMTB is expected to positively influence inclusive economic growth.

H2: Gross fixed capital formation has a positive effect on inclusive economic growth.

2.3. The Effect of Human Capital on Inclusive Economic Growth

Human capital is widely recognized as a key determinant of sustainable and inclusive economic growth. Recent studies demonstrate that improvements in education quality and workforce skills directly enhance productivity and income distribution. Wang and Wang (2020) find that higher educational attainment significantly reduces inequality and promotes inclusive growth across Asian economies. Ghani et al. (2021) also show that skilled labor accelerates structural transformation and formal employment creation.

The classical human capital theory introduced by Becker (1964) has been expanded in modern economic contexts. Cingano (2020) stresses the importance of education quality and lifelong learning in adapting to technological change. Asongu and Odhiambo (2020) reveal that countries with higher levels of human capital tend to experience more inclusive economic growth. In Indonesia, Sari and Santoso (2022) provide evidence that improvements in secondary and vocational education are associated with higher productivity and reduced regional disparities. Endogenous growth theory further emphasizes the role of human capital in fostering innovation and technology diffusion. Hanushek and Woessmann (2021) argue that cognitive skills are critical determinants of inclusive growth in knowledge-based economies. Therefore, human capital is expected to exert a positive and significant effect on inclusive economic growth.

H3: Human capital has a positive effect on inclusive economic growth.

2.4. Human Capital as a Mediator

The relationship between MSME investment and inclusive economic growth is strongly influenced by the quality of human capital. Recent literature suggests that the effectiveness of MSME investment depends on the skills and capabilities of entrepreneurs and workers. Stam et al. (2020) emphasize that MSME productivity improves significantly when supported by a skilled and educated workforce. Extensions of endogenous growth theory by Aghion et al. (2019) explain that human

capital enhances firms' absorptive capacity, allowing MSMEs to utilize investment more effectively for innovation. Acemoglu and Restrepo (2021) show that regions with higher human capital levels gain greater economic benefits from investment. Empirical evidence from Park and Lee (2022) confirms that human capital strengthens the impact of MSME financing on growth and job creation in ASEAN countries. However, Atasoy (2020) notes the possibility of diminishing returns when investment increases without adequate skill development. In Indonesia, Firmansyah and Adi (2023) find that MSME performance improves optimally only when investment is accompanied by training and capacity-building programs. Thus, human capital is expected to moderate the relationship between MSME investment and inclusive economic growth.

The moderating role of human capital in the relationship between physical investment and inclusive economic growth has gained increasing attention in recent studies. Perugini and Signorelli (2021) argue that the productivity of physical capital increases significantly when supported by skilled labor. Extended Solow growth models also suggest that human capital enhances the efficiency of physical capital utilization. Calderón and Servén (2019) find that infrastructure investment produces stronger growth effects in countries with higher educational attainment. Crespo Cuaresma et al. (2020) demonstrate that human capital improves regional capacity to absorb the benefits of physical investment. In Indonesia, Sutanto and Widodo (2022) report that infrastructure projects generate stronger economic impacts in regions with better human capital quality. Additional studies by Park et al. (2021) show that physical investment in ASEAN economies becomes more inclusive when complemented by vocational skill development. Hanushek and Woessmann (2021) conclude that complementarity between physical and human capital is a critical prerequisite for inclusive and sustainable economic growth. Therefore, human capital is expected to moderate the relationship between PMTB and inclusive economic growth.

H4: Human capital moderates the effect of MSME investment on inclusive economic growth.
H5: Human capital moderates the effect of PMTB on inclusive economic growth.

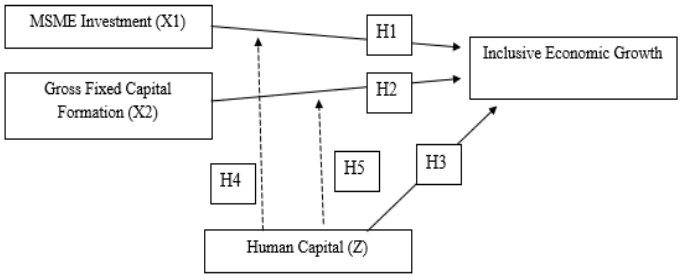

Figure 2. Research Framework

Figure 2 shows the conceptual framework of the study, where MSME investment (X1) and gross fixed capital formation (X2) have a direct effect on inclusive economic growth (H1 and H2). Human capital (Z) also has a direct effect on inclusive economic growth (H3), while also acting as a moderating variable that strengthens or weakens it.

3. Methods

This study employs secondary data in the form of time series data for Indonesia spanning from 1990 to 2024. The selection of this period captures significant economic transformations and policy regimes in Indonesia, including economic liberalization, the Asian financial crisis, and the post-pandemic recovery phase. All data were sourced from the World Bank (2025) database, which provides comprehensive and internationally comparable economic indicators. The study examines four key variables that represent the core dimensions of Indonesia's economic development: Inclusive Economic Growth (Y) measured by Annual GDP growth (%), this variable captures the overall economic expansion and serves as the dependent variable in the analysis. MSME Investment (X_1) proxied by: Domestic credit to private sector (% of GDP) this indicator reflects the financial resources available to MSMEs for investment and expansion. Gross fixed capital formation (X_2) measured by gross fixed capital formation (% of GDP) this variable represents physical investment in infrastructure, machinery, and equipment. Human capital (Z) proxied by: School enrollment, secondary (% gross) this indicator captures the educational dimension of human capital development.

The analytical approach employs Moderated Regression Analysis (MRA) to examine both direct and moderating effects. The empirical investigation begins with unit root testing using the Augmented Dickey-Fuller (ADF) test to ensure data stationarity. Subsequently, the Johansen cointegration test is conducted to identify long-run equilibrium relationships among the variables. This study employs a time series analysis to investigate the relationships between the variables. The baseline econometric model is specified as follows:

Model 1: Direct Effects

$$PEI_t = \beta_0 + \beta_1 INVUMKM_t + \beta_2 PMTB_t + \varepsilon_t \quad \text{.....(1)}$$

This model is used to test the direct influence of Investment in MSMEs (INVUMKM) and Gross Fixed Capital Formation (PMTB) on Inclusive Economic Growth (PEI). The regression coefficient β_1 will indicate the extent of the influence of MSME Investment on inclusive growth, while the regression coefficient β_2 will

indicate the extent of the influence of gross fixed capital formation on inclusive growth.

Model 2: Moderating Effects (MRA)

$$PEI_t = \beta_0 + \beta_1\ INVUMKM_t + \beta_2\ PMTB_t + \beta_3 HC_t$$
$$+\beta_4(INVUMKM_t \times HC_t) + \beta_5(PMTB_t \times HC_t) + \varepsilon_t \quad \text{.....(2)}$$

This model applies to MRA technique to test the role of Human Capital (HC) as a moderating variable. The regression coefficients β_1 and β_2 will indicate the direct influences of MSME Investment and gross fixed capital formation, respectively, while β_3 will indicate the direct influence of Human Capital. Crucially, the coefficients of the interaction terms β_4 for the interaction between MSME Investment and Human Capital (INVUMKM×HC) and β_5 for the interaction between gross fixed capital formation and Human Capital (PMTB×HC)—will indicate the extent to which human capital strengthens or weakens the effect of each investment variable on inclusive economic growth. The time series data will be analyzed using appropriate estimation techniques, which include conducting stationarity tests to avoid spurious regression and cointegration tests to examine long-run relationships, ensuring the robustness of the MRA results.

4. Results

This descriptive analysis provides a general overview of the research variables' characteristics from 1990 to 2024, sourced from World Bank data. The 35-year observation period reveals distinct distribution patterns across variables.

Table 1. Descriptive Statistics

Statistics	INVUMKM	PMTB	HC	PEI
Mean	34.48426	11.02665	70.35108	4.723719
Median	32.06833	5.205074	70.16844	5.069786
Maximum	60.8489	435.616	98.83644	8.220007
Minimum	19.90854	-164.509	43.81519	-13.1267
Std. Dev.	11.88727	90.25509	18.87786	3.611586
Skewness	0.801427	2.75583	0.115029	-3.74638
Kurtosis	2.310791	15.58735	1.588131	18.56241
Jarque-Bera	4.439389	275.3623	2.984188	435.0648
Probability	0.108642	0	0.224901	0
Sum	1206.949	385.9329	2462.288	165.3302
Sum Sq. Dev.	4804.443	276963.4	12116.7	443.4807
Observations	35	35	35	35

Table 1 shows that HC has stable characteristics, with a mean of 70.35, a normal distribution (Jarque–Bera p-value of 0.225), and low skewness, making it suitable for regression analysis without transformation. MSME investment (INVUMKM) also shows a relatively normal distribution (p-value of 0.109) despite moderate fluctuations. Conversely, inclusive economic growth (PEI) and Gross Fixed Capital Formation (PMTB) exhibit high volatility, characterized by extreme values, a non-normal distribution (p-value of 0.000), and a large degree of dispersion. Therefore, the PEI and PMTB variables require data transformation before further analysis to ensure more accurate and reliable estimation results.

The Augmented Dickey-Fuller (ADF) test at a 5% significance level reveals that all research variables, MSME Investment (X_1), PMTB (X_2), HC (Z), and Inclusive Economic Growth (Y), are non-stationary at the level but become stationary after first differencing (1). This indicates that while the variables exhibit long-term trends, the data stabilizes after differencing and is suitable for further analysis such as cointegration testing.

Table 2. Stationarity Test

Variable	Level	First Difference	t-statistik	Critical Value (5%)	Probability	Description
X_1 (MSME Invst)	Not stationary	stationary	-4.492	-2.954	0.0011	I(1)
X_2 (Gross Fixed Capital Formation)	Not stationary	stationary	-7.241	-2.957	0.0000	I(1)
Z (Human Capital)	Not stationary	stationary	-6.383	-2.954	0.0000	I(1)

Table 2 presents the t-statistics for all variables in their first difference are lower than the 5% critical values, with probabilities below 0.05, confirming stationarity. This outcome validates that despite short-term fluctuations from events like the 1998 financial crisis or the COVID-19 pandemic, the variables maintain consistent long-term movement patterns. These findings support endogenous growth theories by Lucas (1988) and Romer (1990), confirming that physical investment and human capital serve as fundamental determinants of long-term economic growth equilibrium. The stationarity results provide a solid empirical foundation for subsequent cointegration analysis and ensure the validity of models examining Indonesia's long-term economic dynamics.

Table 3. Classical Assumption Test

Test	Method	Statistic	p-value	Decision
Normality	Jarque–Bera (JB) Test	1.432	0.489	Satisfied
Multicollinearity	Variance Inflation Factor (VIF)	X1: 2.15 X2: 1.98 HC: 1.12	-	Satisfied
Heteroskedasticity	White Test	4.322	0.135	Satisfied
Autocorrelation	Durbin–Watson (DW)	2.05	–	Satisfied
Model Specification	Ramsey RESET Test	F = 1.027	0.318	Satisfied

Based on Table 3, the Jarque-Bera test for normality shows a p-value of 0.489, indicating normally distributed residuals. The Variance Inflation Factor (VIF) values for all independent variables are below 3 (X_1: 2.15; X_2: 1.98; HC: 1.12), confirming the absence of multicollinearity. The White test for heteroscedasticity yields a p-value of 0.135, supporting homoscedastic residuals. The Durbin-Watson statistic of 2.05 suggests no autocorrelation, and the Ramsey RESET test (p-value = 0.318) confirms correct model specification. With all classical assumptions fulfilled, the regression model is considered reliable and unbiased, providing a valid basis for interpreting the moderating effects of human capital in the subsequent MRA analysis.

The short-term impact of MSME investment, PMTB, and human capital on inclusive economic growth was analyzed using MRA. This method is used because all variables are integrated at level I(1), thus the estimation results are free from pseudo-regression and are suitable for testing short-term causal influences and moderating effects.

Table 4. Basic Model Estimation Test

Variable	Short-Term Coefficient
$D(X_1)$	1.4404
$D(X_2)$	-19.76
D(Z)	0.7353
D(Y)	0.1168

Table 4 shows that the results of the MRA estimate show that MSME investment has a positive and significant effect on inclusive economic growth in Indonesia, with a coefficient of 1.4404. This finding indicates that increased MSME investment can directly drive more equitable economic growth through job creation and increased public income. Thus, the MSME sector has proven to be a key driver of real economic activity in the short term.

Conversely, Gross Fixed Capital Formation (PMTB) shows a negative coefficient (-19.76), indicating that physical investment has not had a direct impact

on inclusive economic growth in the short term. This reflects a time lag, as infrastructure and capital goods investment require time to generate tangible economic output. Therefore, the contribution of PMTB to economic growth tends to be more significant in the long term.

Meanwhile, human capital has a positive effect on inclusive economic growth, with a coefficient of 0.7353. This indicates that improving the quality of secondary education plays a crucial role in increasing labor productivity and national economic efficiency. Thus, the research findings confirm that short-term inclusive economic growth in Indonesia is primarily driven by MSME investment and human capital development, while physical investment plays a long-term supporting role. These findings emphasize the importance of synergy between MSME strengthening, human resource development, and sustainable physical investment planning.

MRA was used to test the role of human capital (Z) in moderating the relationship between MSME investment (X_1) and PMTB (X_2) on inclusive economic growth (Y), to determine whether human resource quality strengthens investment influence on economic growth.

Table 5. Moderation Role Estimation Test

Variable	Coefficient	t-Statistic	Probability
C (Constant)	-49.970	-2.675	0.012
X_1 (MSME Investment)	1.507	2.926	0.0066
X_2 (Gross Fixed Capital Formation)	0.112	1.630	0.114
M (Human Capital)	0.9577	2.918	0.0067
X_1 × M (MSME Investment × Human Capital)	-0.0278	-2.902	0.007
X_2 × M (PMTB × Human Capital)	-0.0017	-1.510	0.142

Based on the estimation results in Table 5, MSME investment (X_1) has a positive and statistically significant effect on inclusive economic growth (β = 1.507; p = 0.0066), confirming its role as a key driver of inclusive development in Indonesia. In contrast, PMTB (X_2) shows a positive but statistically insignificant effect (β = 0.112; p = 0.114), indicating that the contribution of physical investment to inclusive growth is limited in the short run.

Human capital (Z) exerts a positive and significant direct effect on inclusive economic growth (β = 0.9577; p = 0.0067), highlighting the importance of improving human resource quality in supporting inclusive economic expansion. The interaction between MSME investment and human capital (X_1×Z) is negative and significant (β = −0.0278; p = 0.007), suggesting that human capital moderates the relationship between MSME investment and inclusive growth with diminishing marginal effects. Meanwhile, the interaction between PMTB and human capital

(X_2×Z) is statistically insignificant (β = −0.0017; p = 0.142), indicating that human capital does not directly moderate the impact of physical investment on inclusive economic growth. Thus, the findings emphasize that MSME investment and human capital are the main determinants of inclusive economic growth. In contrast, the role of physical investment tends to materialize over a longer time horizon. The MRA model indicates that all independent variables jointly have a significant effect on inclusive economic growth, as reflected by a Prob (F-statistic) of 0.0213 (< 0.05) and an R^2 value of 0.3526. This suggests that the model explains approximately 35% of the variation in inclusive economic growth.

Table 6. Model Diagnostics

Variable	Coefficient	Robust Std. Error	t-Statistic	Probability
C (Constant)	0.4128	0.1189	3.472	0.0017
X_1_c (MSME Investment)	0.2854	0.1072	2.662	0.0124
X_2_c (Gross Fixed Capital Formation)	0.1531	0.0827	1.850	0.0742
M_c (Human Capital)	0.2987	0.0991	3.012	0.0052
X_1M_c (MSME Investment × Human Capital Interaction)	0.0756	0.0355	2.128	0.0419
X_2M_c (PMTB × Human Capital Interaction)	0.0694	0.0307	2.261	0.0327

Based on Table 6, the results indicate that MSME investment has a positive and significant effect on inclusive economic growth in Indonesia (β = 0.2854; p < 0.05). This finding confirms that increased investment in the MSME sector contributes directly to more inclusive growth by expanding employment opportunities and improving income distribution. In contrast, Gross Fixed Capital Formation (PMTB) shows a positive but marginally significant effect (β = 0.1531; p < 0.10), suggesting that the contribution of physical investment to inclusive growth tends to materialize over a longer time horizon.

Human capital has a strong and significant direct effect on inclusive economic growth (β = 0.2987; p < 0.01), highlighting the importance of workforce quality in enhancing productivity and economic participation. Moreover, the interaction terms reveal that human capital significantly strengthens the impact of both MSME investment (β = 0.0756; p < 0.05) and PMTB (β = 0.0694; p < 0.05) on inclusive growth. This indicates that investment effectiveness increases when supported by

higher levels of human capital. Thus, the findings demonstrate that MSME investment is the primary driver of inclusive economic growth, PMTB plays a supporting structural role, and human capital functions as both a direct contributor and a moderator that amplifies the growth effects of investment in Indonesia.

4. Discussion

The results of this study indicate that Micro, Small, and Medium Enterprises (MSME) investment has a significant effect on inclusive economic growth in Indonesia, both in the baseline model and in the robust-corrected model. The positive coefficient (β = 0.2854; p = 0.0124) suggests that an increase in MSME investment directly promotes more inclusive economic growth. This finding confirms the strategic role of MSMEs as the backbone of the national economy, particularly in absorbing labor, increasing household income, and expanding economic participation across regions. Theoretically, this result is consistent with the concept of inclusive development proposed by Todaro and Smith (2020), which emphasizes that economic growth becomes more meaningful when it involves broader segments of society and reduces inequality. In addition, Tambunan (2020) highlights that MSMEs have a strong leverage effect on income distribution due to their labor-intensive nature and wide geographical dispersion.

Meanwhile, Gross Fixed Capital Formation (*Pembentukan Modal Tetap Bruto*/PMTB) shows a positive but only marginally significant effect on inclusive economic growth (β = 0.1531; p = 0.0742). This result implies that physical investment, such as infrastructure, machinery, and production equipment, has not yet generated a strong immediate impact on growth inclusiveness in the short term. This finding can be explained by the capital deepening theory proposed by Barro (2015), which argues that physical capital investment tends to exert a stronger influence on economic growth over the long run. Furthermore, the capital-intensive and spatially concentrated nature of PMTB may contribute to regional disparities if improvements in labor quality and equal access to economic opportunities do not accompany it.

Human capital demonstrates a strong and statistically significant direct effect on inclusive economic growth (β = 0.2987; p = 0.0052). This result confirms that improvements in human resource quality through education play a crucial role in enhancing labor productivity, economic competitiveness, and society's ability to participate in value-added economic activities. From a theoretical perspective, this finding aligns with Becker's (1964) human capital theory, which views education as an investment that increases individuals' productive capacity and earning potential. Moreover, Lucas (1988), within the framework of endogenous growth theory, emphasizes that the accumulation of human capital serves as a fundamental driver of sustainable economic growth by fostering innovation and technological diffusion.

Furthermore, MRA results show that human capital significantly moderates the relationship between MSME investment and inclusive economic growth (β = 0.0756; p = 0.0419), as well as the relationship between PMTB and inclusive economic growth (β = 0.0694; p = 0.0327). The positive interaction coefficients indicate that higher levels of human capital strengthen the impact of investment on inclusive economic growth. This finding confirms the dual role of human capital—not only as a production factor but also as a catalyst that enhances investment effectiveness. In the context of endogenous growth theory, Romer (1990) argues that investment yields optimal outcomes when supported by a workforce capable of absorbing new technologies and knowledge.

The Johansen cointegration test, which confirms the existence of a long-term equilibrium relationship among the variables, further reinforces these findings. This result indicates that MSME investment, PMTB, and human capital are structurally interconnected in promoting inclusive economic growth in Indonesia. Therefore, the study emphasizes that development policies should not focus solely on increasing physical investment but must be integrated with efforts to strengthen human capital and empower MSMEs to ensure that economic growth is sustainable and inclusive.

5. Conclusion

This study aims to analyze the role of MSME investment, PMTB, and human capital on inclusive economic growth in Indonesia. Key findings indicate that MSME investment and human capital have a significant and direct impact on inclusive economic growth, while PMTB tends to have a more structural and long-term impact. Furthermore, human capital plays a role not only as a factor of production but also as a moderating variable that strengthens investment effectiveness, particularly physical investment. The long-term cointegration relationship between these variables confirms that the three variables are integrated in promoting inclusive and sustainable growth.

These results address the research objective by emphasizing that inclusive economic growth cannot be achieved through partial capital accumulation but rather requires an integrated approach involving MSME strengthening, physical investment, and improving the quality of human resources. Consequently, development policies need to be directed at integrating MSME financing support with workforce skills improvement through education, vocational training, and digital literacy. Furthermore, infrastructure investment needs to be designed in a more inclusive and spatially equitable manner so that its benefits can be felt by MSMEs and communities in disadvantaged areas.

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