Signifikan: Jurnal Ilmu Ekonomi
Volume 15(1), 2026: 1 - 18
P-ISSN: 2087-2046; E-ISSN: 2476-9223
https://doi.org/10.15408/sjie.v15i1.46506

Climate Stress, Inflation, and Foreign Investment: Do Growth and Corruption Control Shape Inequality?

Riska Zahara[1], M. Shabri Abd. Majid[2*], Muhammad Abrar[3]
[1,2,3]Department of Economics, Faculty of Economics and Business, Universitas Syiah Kuala, Aceh, Indonesia
E-mail: [1]zahararriskaa@gmail.com, [2]mshabri@usk.ac.id, [3]muhammadabrar@usk.ac.id
[*]**Corresponding author**

JEL Classification:
D63
E31
F21
O44
O43

Received: 15 October 2025

Revised: 15 December 2025

Accepted: 30 December 2025

Available online: April 2026

Published regularly: April 2026

ABSTRACT

Research Originality: This study provides a new contribution by examining climate stress, inflation, and foreign investment within a single integrated framework. By uniting environmental, macroeconomic, and governance factors, it offers a clearer understanding of the structural drivers of inequality in ASEAN-4.

Research Objectives: The study examines the impacts of climate change, inflation, and foreign investment on inequality and evaluates how economic growth and corruption control moderate these effects.

Research Methods: The study uses annual panel data for Indonesia, Malaysia, Thailand, and the Philippines from 2002 to 2023 and applies moderated panel regression analysis to estimate both direct and interaction effects.

Empirical Results: Climate pressures and foreign investment increase inequality, while inflation slightly reduces it. The analysis also shows that economic growth lessens the inequality effect of foreign investment, whereas stronger corruption control unexpectedly amplifies it, suggesting that better governance does not automatically ensure fairer investment outcomes.

Implications: These findings suggest that ASEAN-4 policymakers must align inclusive growth, inflation stability, environmental action, and improved governance to effectively reduce inequality and support sustainable development.

Keywords:

income inequality; climate change; foreign direct investment; economic growth; corruption control

How to Cite:

Zahara, R., Majid, M. S. A., & Abrar, M. (2026). Climate Stress, Inflation, and Foreign Investment: Do Growth and Corruption Control Shape Inequality?. *Signifikan: Jurnal Ilmu Ekonomi*, *15*(1), 1-18. https://doi.org/10.15408/sjie.v15i1.46506.

INTRODUCTION

Income inequality remains a major challenge in modern economic development (Kuznets, 2019; Vitkovics, 2023; Agustina et al., 2023). Although many countries have succeeded in reducing poverty and improving average living standards, unequal income distribution persists and, in some cases, has even widened (Umair et al., 2024). The effects of inequality go beyond issues of fairness. Large income gaps are closely linked to political instability, weaker social cohesion, and slower long-term economic growth (Paddu et al., 2025). In developing and emerging economies, inequality is often shaped by multiple structural problems, such as climate risks, macroeconomic instability, and weak governance (Sahu & Mahalik, 2024; Tavares et al., 2025). These issues are particularly relevant in the ASEAN region, where rapid economic growth has not always produced equally shared benefits.

Evidence from ASEAN highlights the seriousness of the problem. The International Monetary Fund notes that inequality can influence economic growth and sustainability. When income growth is concentrated among the richest 20 percent, medium-term GDP growth may actually slow because the benefits are not widely shared (Norris et al., 2015). Data from the World Inequality Database (2025) show that the average Gini ratio in ASEAN has remained around 0.46 over the last two decades, which is considered high globally. Indonesia has the highest inequality in the region, with an average Gini ratio of 0.54, followed by Cambodia at 0.51, while Brunei Darussalam records the lowest at 0.36. In the ASEAN-4 countries, inequality also remains high: Thailand reached 0.52 in 2023, the Philippines averages about 0.47, and Malaysia records 0.42. These differences are largely caused by uneven economic development, regional disparities, and differences in labor skills (Fai & Tomlinson, 2023). Although Indonesia, Malaysia, Thailand, and the Philippines are classified by the World Bank as upper-middle-income countries with per capita incomes between USD 4,466 and USD 13,845, their high levels of inequality indicate that economic growth has not been fully inclusive.

Climate change is another important factor that can worsen inequality. Studies show that environmental shocks—such as extreme weather events and rising temperatures—tend to affect low-income groups more severely, which increases income inequality (Cevik & Jalles, 2023; Singer, 2018; Parsons et al., 2025). For example, a one-percent increase in climate vulnerability is associated with a 1.5-percent rise in inequality. This occurs because poorer households and sectors generally have less capacity to adapt to environmental risks. As a result, climate change is now widely seen not only as an environmental problem but also as an issue related to fairness and income distribution (Davidson, 2021). Recent studies reinforce this argument. Barra et al. (2025) show that uncertainty in economic, climate, and energy policies can change the relationship between environmental conditions and economic growth, often increasing inequality. Similarly, Acheampong et al. (2024) find that high inequality can slow the transition to renewable energy and maintain reliance on non-renewable resources, indicating a strong link between energy systems and income inequality.

http://journal.uinjkt.ac.id/index.php/signifikan
https://doi.org/10.15408/sjie.v15i1.46506

Macroeconomic conditions, particularly inflation, also play an important role in shaping income inequality (Memon & Qureshi, 2021). While moderate inflation can support economic activity, high or prolonged inflation tends to reduce the purchasing power of poorer households and increase inequality. Research suggests a threshold effect: when inflation rises above 6%, it generally worsens income disparities (Glawe & Wagner, 2024). However, the evidence is not always consistent. Some studies argue that wealthier groups are better protected from inflation because they own assets, while others find nonlinear or U-shaped relationships between inflation and inequality (Zheng et al., 2020; Walsh & Yu, 2012). Inflation can also increase inequality over time, especially when it occurs alongside unemployment and weak institutions (Abdi et al., 2025). These mixed findings highlight the importance of examining inflation in specific economic contexts, particularly in emerging markets where inflation shocks often occur and affect social groups differently.

Foreign Direct Investment (FDI) is another factor that influences income inequality, though its impact remains debated. On one side, FDI can create jobs, transfer technology, and increase productivity, which may help reduce inequality over the long run (Ravinthirakumaran & Ravinthirakumaran, 2018). On the other side, when FDI is concentrated in capital-intensive industries or specific regions, it may increase inequality by benefiting mainly skilled workers or urban areas (Le et al., 2021; Suanes, 2016). Research also suggests that the effect of FDI may be nonlinear and depend on institutional quality and a country's ability to absorb investment benefits (Figini & Görg, 2011). Supporting this complexity, Abdi et al. (2025) find that FDI reduces inequality only in the short term, while globalization may increase disparities over time. In Indonesia, Handayani et al. (2022) show that FDI can reduce inequality when it is accompanied by strong economic growth. Meanwhile, research on ASEAN+3 by Shaari et al. (2022) indicates that lower corruption attracts more FDI, although environmental degradation can also draw investment, reflecting pollution-haven behavior. Therefore, the effect of FDI on income distribution must be understood within the broader economic and governance context.

The effects of these factors are also shaped by moderating variables such as economic growth and corruption control. Strong economic growth can reduce the inequality effects of FDI by creating more jobs and enabling redistribution through government spending (Gam et al., 2023). In contrast, weak or uneven growth may increase inequality if the gains from foreign investment benefit only a small group. Governance quality, particularly corruption control, is also crucial. Strong institutions and effective anti-corruption policies can ensure that FDI contributes to inclusive development. In contrast, weak governance may lead to elite capture, rent-seeking, and concentration of investment benefits in certain regions, which can increase inequality (Acemoglu & Robinson, 2012; Le et al., 2021). Supporting this argument, Hakimi and Hamdi (2017) find that corruption reduces economic growth and discourages FDI, thereby reinforcing inequality. Other evidence also emphasizes that reducing corruption and inequality is important for achieving inclusive development and supporting cleaner energy transitions (Acheampong et al., 2024).

These issues are particularly relevant for the ASEAN-4 countries—Indonesia, Malaysia, Thailand, and the Philippines. Although these economies have experienced steady economic growth, inequality remains deeply rooted and continues alongside climate vulnerability, inflation instability, and governance challenges. As members of an increasingly integrated regional economy, ASEAN-4 countries are highly exposed to global capital flows. This makes FDI both an important source of economic growth and a potential contributor to inequality. However, only a limited number of studies examine how environmental pressures, macroeconomic conditions, and governance factors together influence inequality in these countries.

Existing empirical research also provides mixed results. Some studies find that FDI can reduce inequality when economic growth is strong (Gam et al., 2023). However, other research shows that in countries with weak institutions, FDI may actually increase inequality (Le et al., 2021). The relationship between inflation and inequality is also debated, with some studies finding no effect, while others report inequality-reducing or inequality-increasing outcomes depending on the context (Wijayanti & Aisyah, 2022; Glawe & Wagner, 2024; Zheng et al., 2020). These differing findings suggest that earlier studies have not fully considered the combined effects of environmental pressures, macroeconomic conditions, and institutional quality, nor how these factors interact to influence inequality in ASEAN-4 countries.

Against this background, this study positions itself by addressing a clear research gap. First, it integrates climate change, inflation, and FDI into a single analytical framework, a rare approach in ASEAN-focused inequality studies. Second, it introduces economic growth and corruption control as moderators to capture how structural and governance conditions shape the effects of macroeconomic and environmental forces on inequality. Third, it provides a region-specific comparative analysis, offering insights that global or single-country studies cannot capture.

Using annual panel data for 2002–2023 and panel regression with moderation analysis, this study contributes to the literature in three key ways. It presents a unified model linking environmental, macroeconomic, and institutional determinants of inequality; delivers comparative evidence tailored to ASEAN-4's shared development challenges; and generates policy-relevant implications for how growth and anti-corruption strategies can reduce inequality under climate and economic pressures. Together, these contributions establish the study's novelty and relevance and underscore why the topic remains compelling for both scholars and policymakers.

METHODS

This study uses annual panel data that combine cross-sectional observations from four ASEAN countries—Indonesia, Malaysia, Thailand, and the Philippines—with time-series data from 2002 to 2023, resulting in 88 observations. These countries are selected because they represent the core ASEAN-4 group and are consistently classified by the World Bank as upper-middle-income economies with similar structural characteristics. They also have

http://journal.uinjkt.ac.id/index.php/signifikan
https://doi.org/10.15408/sjie.v15i1.46506

more complete data on environmental, macroeconomic, and governance indicators. Other ASEAN countries lack consistent long-term data for key variables such as corruption control, climate indicators, and income inequality, making it difficult to construct a balanced panel for moderation analysis. The period 2002–2023 is chosen because 2002 is the earliest year when all variables—climate indicators, FDI inflows, inflation, and governance measures—are available and consistently reported for the ASEAN-4. The endpoint of 2023 allows the study to capture recent economic developments, including post-Asian Financial Crisis reforms, deeper global integration, and increasing climate-related pressures.

The dataset includes six main variables to examine the interaction between environmental factors, macroeconomic conditions, and institutional quality. The dependent variable is income inequality (IIE), measured by the Gini index from the World Inequality Database. Two moderating variables are economic growth (EGR) and corruption control (CRC). Economic growth is represented by GDP per capita, while corruption control is taken from the Worldwide Governance Indicators and reflects the extent of corruption, state capture, and the effectiveness of institutions.

The independent variables capture the key economic and environmental factors that affect inequality. Climate change (CLC) is measured using CO_2 emissions intensity, defined as the amount of carbon dioxide emissions per unit of GDP, which reflects the environmental impact of economic activity. Inflation (INF) is measured as the annual percentage change in the Consumer Price Index (CPI), indicating price instability and its impact on household purchasing power. Foreign direct investment (FDI) is measured as net inflows as a percentage of GDP, representing foreign capital entering the economy and its potential influence on income distribution.

The empirical analysis applies panel regression techniques to estimate the relationships among these variables. The baseline specification tests the effects of climate change, inflation, and FDI on income inequality, followed by extended models incorporating interaction terms to assess the moderating roles of economic growth and corruption control. The baseline model is expressed in Equation (1):

$$IIE_{it} = \alpha + \beta_{11}CLC_{it} + \beta_{12}INF_{it} + \beta_{13}FDI_{it} + \varepsilon_{it} \quad (1)$$

Because the independent variables differ in scale and magnitude, the model is further transformed using natural logarithms, as shown in Equation (2):

$$LogIIEit = \alpha + \beta_{11}LogCLC_{it} + \beta_{12}INF_{it} + \beta_{13}FDI_{it} + \varepsilon_{it} \quad (2)$$

To extend the analysis, this study also incorporates a moderation framework using Moderated Regression Analysis (MRA). Specifically, it evaluates the roles of economic growth and corruption control as moderating variables in the relationship between FDI and income inequality. These are captured in the following models:

$$LogIIE_{it} = \alpha + \beta_{21}FDI_{it} + \beta_{22}LogGRW_{it} + \beta_{23}FDI_{it}*LogGRW_{it} + \varepsilon_{it} \quad (3a)$$

$$LogIIE_{it} = \alpha + \beta_{31}FDI_{it} + \beta_{32}LogCRC_{it} + \beta_{33}FDI_{it}*LogCRC_{it} + \varepsilon_{it} \quad (3b)$$

where Log is the natural logarithm, IIE is income inequality, CLC is climate change, INF is is inflation is is foreign direct investment, α is the constant, ε is the error term, i denotes the cross-sectional unit (country), and t represents the time period.

For estimation, the study employs three alternative panel regression models: the Common Effect Model (CEM) or Pooled Least Squares (PLS), the Fixed Effect Model (FEM), and the Random Effect Model (REM). The CEM represents the simplest specification, assuming homogeneous behavior across both cross-sections and time periods. By contrast, FEM controls for unobserved country-specific effects that remain constant over time, while REM assumes that unobserved heterogeneity is random and uncorrelated with the regressors. REM is also known as the Error Component Model (ECM), estimated using Generalized Least Squares (GLS) techniques. The general functional form is presented in Equation (4):

$$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it} \quad (4)$$

where Y_{it} denotes the dependent variable for country i at time t, α is the intercept term, X_{it} is the vector of independent variables, β represents the corresponding regression coefficients that measure the magnitude and direction of the relationships, and ε_{it} is the stochastic error term capturing unobserved factors not included in the model.

The appropriate specification of the panel regression model was determined through a sequence of model selection tests, namely the Chow test, the Hausman test, and the Lagrange Multiplier (LM) test. The Chow test is used to discriminate between the Common Effect Model (CEM), also known as Pooled Least Squares (PLS), and the Fixed Effect Model (FEM). It does so by evaluating whether cross-sectional intercepts are homogeneous across entities. The Hausman test is subsequently applied to differentiate between FEM and the Random Effect Model (REM). This test assesses whether the unobserved individual-specific effects are correlated with the regressors. Finally, the Lagrange Multiplier (LM) test, as introduced by Breusch and Pagan (1980), is conducted to decide between REM and CEM.

RESULTS AND DISCUSSION

The results of this study reveal three key empirical findings. First, climate change significantly increases income inequality in ASEAN-4, indicating that environmental stress disproportionately affects lower-income groups. Second, inflation within the observed range reduces inequality, suggesting a mild equalizing effect when price increases remain manageable. Third, foreign direct investment tends to widen inequality, though its impact varies when economic growth and corruption control are considered moderating

http://journal.uinjkt.ac.id/index.php/signifikan
https://doi.org/10.15408/sjie.v15i1.46506

factors. These main findings are elaborated through descriptive statistics and econometric estimations presented below.

To provide initial context, Table 1 presents the descriptive statistics for the variables used in this study, offering a preliminary picture of the economic, environmental, and institutional characteristics of the ASEAN-4 countries over the period 2002–2023. The results highlight considerable heterogeneity across observations, particularly for inflation and foreign direct investment, which exhibit the widest fluctuations among the variables.

The descriptive statistics for all variables included in this study are reported in Table 1. The results reveal that income inequality (IIE), measured by the Gini index, averages 0.46 across ASEAN-4, ranging from 0.40 to 0.56, confirming the persistence of relatively high inequality during the period of analysis. Economic growth (GRW), proxied by GDP per capita, has a mean of USD 13,473 but ranges from USD 3,580 to USD 36,417, reflecting substantial differences in output levels across countries and years. Corruption control (CRC) scores only 0.13 on the governance index, underscoring limited institutional effectiveness in curbing rent-seeking and uneven enforcement of anti-corruption measures.

Table 1. Descriptive Statistics

	IIE (Index)	GRW (US$)	CRC (Index)	CLC (US$)	INF (Percent)	FDI (Percent)
Mean	0.4664	13473.09	0.1394	0.6471	3.4726	2.2879
Median	0.4600	11547.50	0.1378	0.6750	3.0900	2.2900
Maximum	0.5600	36417.00	0.1603	0.9800	13.1000	5.4200
Minimum	0.4000	3580.000	0.1223	0.3500	-1.2300	-0.8600
Std. Dev	0.0458	7560.582	0.0097	0.1831	2.6387	1.2418

Source: Processed results from secondary data (2025).

Turning to the independent variables, climate change intensity (CLC), expressed as CO_2 emissions per unit of GDP, averages 0.64, ranging from 0.35 to 0.98, highlighting the environmental burden of economic activity in the region. Inflation (INF) shows considerable volatility, ranging from –1.23 percent to 13.1 percent, although its average remains moderate at 3.47 percent. FDI inflows, expressed as a share of GDP, average 2.28 percent but fluctuate sharply between –0.86 and 5.42 percent, indicating uneven patterns of external capital integration. Overall, the descriptive results emphasize three important features: (i) inequality remains structurally entrenched at relatively high levels; (ii) economic growth and external investment are marked by significant variation across space and time; and (iii) governance weaknesses and environmental stress persist as additional constraints on inclusive development. These dynamics provide the rationale for further econometric investigation into how growth and corruption control may moderate the effects of macroeconomic and environmental factors on inequality in ASEAN-4.

Selecting an appropriate panel data model is a critical step to ensure the accuracy and consistency of econometric estimation. In this study, model specification was guided by both theoretical considerations in variable selection and econometric diagnostics to determine whether the Common Effect Model (CEM), Fixed Effect Model (FEM), or Random Effect Model (REM) provides the best fit for the dataset. To this end, three complementary statistical procedures were applied: the Chow test, the Hausman test, and the Lagrange Multiplier (LM) test. These tests are designed to evaluate unobserved heterogeneity across cross-sections, the correlation between regressors and individual effects, and the efficiency gains from random effects estimation.

The results presented in Table 2 demonstrate a consistent pattern across all three model specifications. In Model I, which estimates the direct effects of climate change, inflation, and FDI on income inequality, both the Chow and Hausman tests yield highly significant results, rejecting the null hypotheses in favor of FEM. In Model II, where economic growth interacts with FDI as a moderating variable, the Chow and Hausman statistics again confirm FEM as the superior model. Finally, in Model III, which examines the moderating role of corruption control on the FDI–inequality relationship, the same conclusion holds: the FEM is the most appropriate specification. These findings suggest that unobserved country-specific characteristics—such as structural differences in economic development, institutional quality, or social policy regimes—are not only present but also correlated with the explanatory variables. The FEM, by allowing intercepts to vary across countries, captures this heterogeneity more effectively than either the pooled or random specifications. Consequently, all subsequent estimations in this study rely on the Fixed Effect Model, ensuring both statistical consistency and theoretical coherence.

Table 2. Results of the Chow and Hausman Tests

Model		Effects Test	Statistic	Prob.	Decision
Model I (IIE)	Uji Chow	Cross-section F	99.4887***	0.0000	FEM
		Cross-section Chi-square	135.8998***	0.0000	
	Uji Hausman	Cross-section random	298.4662***	0.0000	FEM
Model II (GRW*FDI)	Uji Chow	Cross-section F	82.9542***	0.0000	FEM
		Cross-section Chi-square	123.5720***	0.0000	
	Uji Hausman	Cross-section random	248.8627***	0.0000	FEM
Model III (CRC*FDI)	Uji Chow	Cross-section F	96.3841***	0.0000	FEM
		Cross-section Chi-square	133.7129***	0.0000	
	Uji Hausman	Cross-section random	289.1523***	0.0000	FEM

Source: Processed results from secondary data (2025).
Note: *** denotes significance at the 1% level.

The first stage of the analysis examines the direct effects of climate change, inflation, and foreign direct investment (FDI) on income inequality in the ASEAN-4

http://journal.uinjkt.ac.id/index.php/signifikan
https://doi.org/10.15408/sjie.v15i1.46506

countries. The results, estimated using a fixed-effect model, are presented in Table 3. The findings show that climate change has a positive and highly significant impact on income inequality. The coefficient of 0.17 suggests that a one-point increase in climate vulnerability is associated with a 17.39% increase in inequality. This result highlights the unequal impact of environmental shocks, which tend to affect poorer households and workers in climate-sensitive sectors more severely. Similar findings are reported by Malpede and Percoco (2021) and Cevik and Jalles (2021), who argue that the negative distributional effects of climate risks are stronger in developing countries due to limited capacity for adaptation and mitigation. More recent research by Méjean et al. (2024) also shows that climate-related disruptions, such as extreme weather events, can increase inequality both directly—through productivity losses in agriculture and informal sectors—and indirectly by reinforcing poverty traps. However, Otrachshenko and Popova (2021) note that extreme temperature exposure does not always increase inequality, as factors such as labor mobility and regional industrial structures may influence the outcome.

For inflation (INF), the estimated coefficient is –0.0056, indicating a negative relationship between inflation and inequality. This means that a 1% increase in inflation is associated with a small reduction in inequality of about 0.004%. This result supports the idea of a nonlinear or U-shaped relationship between inflation and inequality. At lower levels, inflation may reduce inequality by lowering the real value of debt and narrowing wage differences, thereby benefiting lower-income groups. However, when inflation becomes too high, it can harm poorer households by reducing their purchasing power. Similar patterns have been found in studies of OECD countries and the United States (Zheng et al., 2020; Balcilar et al., 2018). In the ASEAN context, Walsh and Yu (2012) argue that food inflation does not always increase inequality because income gains in other sectors may offset the negative effects on poorer households. However, other studies provide different conclusions. Uspri (2023) and Gros & Shamsfakhr (2023) find that inflation can reduce real wages and purchasing power, thereby increasing inequality under certain conditions.

Table 3. Panel Regression Results (Model I):
Direct Effects of Climate Change, Inflation, and FDI on Income Inequality

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	-0.6812***	0.0300	-2.2686	0.0000
CLC	0.1739***	0.0490	3.5460	0.0007
INF	-0.0056***	0.0024	-2.3283	0.0224
FDI	0.0089**	0.0045	1.9721	0.0520
R-squared	0.8041		F-statistic	55.4228
Adjusted R-squared	0.7896		Prob(F-statistic)	0.0000

Source: Processed results from secondary data (2025).
Note: *** and ** denote significance at the 1% and 5% levels, respectively.

Finally, the results reveal that FDI inflows are positively associated with inequality. This result implies that a 1% increase in FDI inflows increases income inequality, reflecting the uneven distribution of investment benefits across regions and industries. In many developing economies, FDI tends to be concentrated in capital-intensive or export-oriented sectors, thereby disproportionately benefiting skilled labor and urban centers while bypassing rural areas. This is consistent with Suanes (2016) in Latin America, Saucedo et al. (2020) in Mexico, and Ma (2025 in China, which collectively argue that FDI often widens wage gaps in developing countries. Nonetheless, the literature also points to nonlinear effects. Figini and Görg (2011) and Le et al. (2021) report that while FDI inflows initially worsen inequality, at higher levels they can reduce inequality by creating broader spillovers, enhancing technology diffusion, and expanding labor demand. Similarly, Chen and Wu (2019) find that FDI can reduce the Gini coefficient by improving productivity, suggesting that the inequality effect of FDI depends heavily on the absorptive capacity and institutional quality of host countries.

Table 4. Interaction Test Results (Model II):
The Moderating Role of Economic Growth in the FDI–Inequality Nexus

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	-0.5279***	0.1848	-2.8566	0.0054
FDI	0.1757***	0.0734	2.3941	0.0190
GRW	-0.0275	0.0197	-1.3965	0.1664
GRW*FDI	-0.0174***	0.0077	-2.2641	0.0262
R-squared	0.8105		F-statistic	57.7590
Adjusted R-squared	0.7965		Prob(F-statistic)	0.0000

Source: Processed results from secondary data (2025).
Note: *** and ** denote significance at the 1% and 5% levels, respectively.

The interaction test using economic growth as a moderating variable is reported in Table 4. The results show that FDI maintains a positive and significant effect on income inequality, indicating that, in the absence of moderating influences, capital inflows tend to widen disparities. Economic growth, proxied by GDP per capita, exhibits a negative coefficient, suggesting that, although the effect is statistically insignificant, higher economic growth is associated with reductions in inequality. Substantively, a 1% increase in economic growth is estimated to lower income inequality by 0.02%.

More importantly, the interaction term between FDI and economic growth is negative, implying that economic growth effectively moderates the relationship between FDI and inequality. In practical terms, this means that in countries with higher economic growth, the inequality-widening effect of FDI diminishes, and FDI can even help reduce disparities. Thus, economic expansion enhances the absorptive capacity of host economies, enabling a broader distribution of the benefits from foreign investment. These findings align with

http://journal.uinjkt.ac.id/index.php/signifikan
https://doi.org/10.15408/sjie.v15i1.46506

those of Gam et al. (2023), who show that although FDI tends to widen inequality, strong economic growth can reverse this effect by broadening employment opportunities and boosting productivity. This pattern reflects the Kuznets (1955) hypothesis, which predicts rising inequality during early industrialization followed by declines as economies diversify and labor markets strengthen—a view echoed by Alamanda (2021), who notes that early-stage rural–urban migration and wage stagnation initially heighten disparities before inclusive policies and rising labor demand gradually narrow gaps. Evidence from Abdi et al. (2025) further supports this trajectory, showing that GDP per capita initially increases inequality in Somalia but that this effect weakens over time, while FDI reduces inequality only in the short run. These results underscore the importance of growth conditions and institutional context, consistent with the moderating role of growth observed in the ASEAN-4. Fazaalloh (2019) similarly finds that FDI's inequality-reducing effects emerge only when growth is taken into account, as technology transfer, skill upgrading, and productivity gains materialize more broadly in expanding economies.

Beyond growth, the interaction between climate pressures and inequality in this study reflects broader global evidence. Barra et al. (2025) show that environmental and policy uncertainty can alter the Environmental Kuznets Curve, intensifying distributional vulnerabilities, while Acheampong et al. (2024) demonstrate that inequality itself can reinforce environmental degradation by reducing renewable energy adoption. This mirrors the ASEAN-4 context, where climate stress, low adaptive capacity, and unequal access to environmental protection jointly amplify inequality. Indonesian evidence from Handayani et al. (2022) further confirms that while growth and FDI can reduce inequality, higher CO_2 emissions worsen it by disproportionately harming low-income groups through both economic and health channels. These parallels collectively strengthen the positioning of the present study by showing that ASEAN-4 shares common structural constraints, and that the interplay between growth, investment, and environmental pressures is central to understanding inequality dynamics in the region.

The third model introduces corruption control (CRC) as a moderating variable to examine whether stronger governance institutions influence the impact of foreign direct investment (FDI) on inequality. The results, shown in Table 5, indicate that FDI continues to have a positive and significant effect on income inequality, consistent with Model I. This suggests that foreign capital inflows may widen disparities when their benefits are unevenly distributed. The coefficient for corruption control is negative (–0.271), implying that stronger institutions are associated with lower inequality, although the effect is statistically insignificant ($p = 0.117$). A one-unit increase in CRC is estimated to reduce inequality by about 0.27%, indicating that anti-corruption efforts may support more equitable outcomes, even though their direct impact remains limited in this sample.

The interaction between FDI and corruption control (CRC*FDI) is positive. This unexpected result suggests that when corruption is more effectively controlled, the inequality-increasing effect of FDI becomes stronger. One possible explanation is that FDI

in ASEAN-4 tends to be concentrated in certain regions and sectors. As a result, even with better governance, foreign investment mainly benefits skilled workers, urban areas, or well-connected firms. In this situation, reducing corruption does not automatically ensure that investment benefits are distributed widely, especially when FDI remains focused on capital-intensive industries.

Table 5. Interaction Test (Model III):
The Moderating Role of Corruption Control in the FDI–Inequality Nexus

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	-1.3139***	0.3345	-3.9271	0.0002
FDI	0.3231***	0.1334	2.4208	0.0177
CRC	-0.2710	0.1712	-1.5827	0.1174
CRC*FDI	0.1601***	0.0682	2.3470	0.0214
R-squared	0.7889		F-statistic	50.4531
Adjusted R-squared	0.7732		Prob(F-statistic)	0.0000

Source: Processed results from secondary data (2025).
Note: *** and *** denote significance at the 1% and 5% levels, respectively.

These findings are consistent with those of Le et al. (2021), who argue that although FDI often increases inequality, its impact depends on institutional quality and the extent of investment distribution. Even strong institutions may not prevent inequality if FDI remains concentrated in urban or capital-intensive sectors, a pattern also seen in ASEAN-4. This supports the argument of Acemoglu and Robinson (2012) that institutional reforms alone cannot reduce inequality without inclusive development and redistribution policies. The result may also reflect the dynamics discussed by Dobson & Ramlogan-Dobson (2012) and Davidescu et al. (2022), who suggest that in economies with large informal sectors, corruption can sometimes act as an informal redistribution mechanism. When corruption is reduced without expanding formal economic opportunities, inequality may increase. In contrast, Hakimi and Hamdi (2017) find that corruption discourages FDI in MENA countries, while in ASEAN-4 foreign investment continues despite governance differences. This means inequality outcomes depend more on sectoral concentration and the ability of economies to absorb investment benefits than on corruption levels alone. Evidence from Shaari et al. (2022) also shows that environmental degradation can attract FDI in ASEAN+3, suggesting that when FDI flows to pollution-intensive industries, economic gains are concentrated while environmental costs fall more heavily on poorer communities, further increasing inequality.

Other studies also highlight complex relationships between corruption and inequality. Davidescu et al. (2022) and Dobson & Ramlogan-Dobson (2012) suggest that higher corruption can sometimes be associated with lower inequality because informal-sector activities may redistribute resources. When the informal sector accounts

http://journal.uinjkt.ac.id/index.php/signifikan
https://doi.org/10.15408/sjie.v15i1.46506

for a large share of GDP, corruption may serve as an alternative allocation mechanism. However, when the informal sector accounts for more than one-fifth of total output, corruption no longer reduces inequality, suggesting that this relationship depends heavily on economic conditions. Overall, Model III's results show the complex role of institutions in the relationship between FDI and inequality. Although stronger corruption control is expected to reduce inequality, in ASEAN-4, it appears to strengthen the inequality-increasing effect of FDI. This suggests that institutional reforms must be supported by policies that more evenly distribute foreign investment. Such policies may include targeted infrastructure development, investment in human capital, and incentives for FDI in labor-intensive sectors so that the benefits of improved governance can lead to more equal outcomes.

More broadly, the study contributes to the literature in several ways. First, it combines environmental, macroeconomic, and institutional factors in a single empirical framework, an approach rarely used in studies of ASEAN economies. Second, the results show that the impact of FDI on inequality depends strongly on structural conditions, especially economic growth and corruption control, extending the findings of Abdi et al. (2025), Le et al. (2021), and Fazaalloh (2019). Third, the study shows that improvements in governance can unintentionally increase inequality when foreign investment remains concentrated in specific sectors or locations. Together, these findings help explain mixed results in previous research and provide new insights into how environmental pressures, macroeconomic conditions, and institutional quality shape inequality in ASEAN-4.

CONCLUSION

This study provides new evidence on the drivers of income inequality in the ASEAN-4 by examining environmental, macroeconomic, and institutional factors together. The results show that climate change and foreign direct investment (FDI) tend to increase inequality, while inflation slightly reduces inequality within the observed range. The analysis also finds that economic growth weakens the inequality-increasing effect of FDI. In contrast, stronger corruption control appears to intensify the inequality impact of FDI, suggesting that investment benefits are not evenly distributed. Overall, the findings indicate that inequality in ASEAN-4 is shaped not only by external shocks but also by economic growth patterns and institutional conditions.

These findings have several policy implications. First, governments need to ensure that FDI supports inclusive development rather than benefiting only specific sectors or regions. This can be done by encouraging investment in labor-intensive industries, strengthening connections between foreign companies and local suppliers, and promoting balanced regional investment. Second, improving absorptive capacity is essential. Investments in education, skills, and technology can help workers and domestic firms benefit from productivity gains brought by FDI. Third, inflation management should not focus only on price stability. Because moderate inflation may sometimes reduce inequality, monetary

policy should also be supported by social protection programs such as wage support, food price policies, and targeted cash transfers to protect low-income households. Fourth, the strong effect of climate change on inequality highlights the need to integrate climate policies into development strategies. Expanding climate-resilient infrastructure, protecting vulnerable livelihoods, and reducing environmental risks are important to prevent climate shocks from widening income gaps. Finally, the results suggest that governance reforms alone are not enough. Anti-corruption policies should be combined with transparent investment allocation, monitoring of sectoral concentration, and safeguards against elite capture. Measures such as public disclosure of investment flows, participatory local budgeting, and clear requirements for foreign investors can help ensure that investment benefits are distributed more fairly.

Future research can expand this analysis by including additional institutional indicators, such as the rule of law and regulatory quality, to better understand governance differences within ASEAN-4. Examining sectoral differences in FDI—such as manufacturing, services, and extractive industries—could also provide deeper insights into how foreign investment affects inequality. From a methodological perspective, future studies may employ dynamic panel models or nonlinear approaches to better capture long-term and threshold effects. Comparative studies involving other emerging regions would also help broaden understanding of how climate change, macroeconomic conditions, and governance jointly influence income inequality.

ACKNOWLEDGEMENT

This research received financial support from the Directorate of Research, Technology, and Community Service (DRTPM), Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, in collaboration with the Institute for Research and Community Service (LPPM), Universitas Syiah Kuala (USK). The study was funded through the Master's Thesis Research Program under Contract No. 193/UN11.L1/PG.01.03/DPPM/2025.

REFERENCES

Abdi, A. H., Mohamed, A. A., Mohamed, A. A., & Mohamed, A. A. (2025). Do Globalization, Foreign Direct Investment, and Inflation Drive Income Inequality? Evidence from Somalia Within The Kuznets Curve Hypothesis. *Research in Globalization*, *11*, 100301. https://doi.org/10.1016/j.resglo.2025.100301.

Acemoglu, D., & Robinson, J. A. (2012). *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*. New York: Crown Publishers.

Acheampong, A. O., Boateng, E., & Annor, C. B. (2024). Do Corruption, Income Inequality and Redistribution Hasten Transition towards (Non)Renewable Energy Economy? *Structural Change and Economic Dynamics, 68*, 329–354. https://doi.org/10.1016/j.strueco.2023.11.006.

http://journal.uinjkt.ac.id/index.php/signifikan
https://doi.org/10.15408/sjie.v15i1.46506

Agustina, M., Majid, M. S. A., Faisal, F., & Musnadi, S. (2023). Does Islamic Banking Sector Matter for Income Disparity Reduction? Empirical Evidence from Indonesia. *International Journal of Professional Business Review*, 8(5), 1–17. https://doi.org/10.26668/businessreview/2023.v8i5.1475.

Alamanda, A. (2021). The Effect of Economic Growth on Income Inequality: Panel Data Analysis from Fifty Countries. *Info Artha*, 5(1), 1–10. https://doi.org/10.31092/jia.v5i1.1176.

Balcilar, M., Gupta, R., & Jooste, C. (2017). The Growth-Inflation Nexus for the US from 1801 to 2013: A Semiparametric Approach. *Journal of Applied Economics*, *20*(1), 105-120. https://doi.org/10.1016/S1514-0326(17)30005-3.

Barra, C., Falcone, P. M., & Giganti, P. (2025). Exploring the Impact of Economic, Climate, and Energy Policy Uncertainty on the Environmental Kuznets Curve: International Evidence. *International Economics, 182*, 100592. https://doi.org/10.1016/j.inteco.2025.100592.

Cevik, S., & Jalles, J. T. (2023). For Whom the Bell Tolls: Climate Change and Income Inequality. *Energy Policy*, 174 (1), 1-11. https://doi.org/10.1016/j.enpol.2023.113475.

Chen, C., & Wu, Y. (2019). Interregional Impact of Foreign Direct Investment on China's Inland Urbanization. *The Singapore Economic Review*, 64(04), 997–1017. https://doi.org/10.1142/S0217590817450035.

Davidescu, A. A., Nae, T. M., & Florescu, M. S. (2022). Exploring the Moderation and Mediation Effects in Addressing the Main Determinants of Income Inequalities in Supporting Quality of Life: Insights from CEE Countries. *International Journal of Environmental Research and Public Health, 19*(14), 1–28. https://doi.org/10.3390/ijerph19148555.

Davidson, M. D. (2021). How Fairness Principles in the Climate Debate Relate to Theories of Distributive Justice. *Sustainability*, 13(13), 1–16. https://doi.org/10.3390/su13137302.

Dobson, S., & Ramlogan-Dobson, C. (2012). Inequality, Corruption, and the Informal Sector. *Economics Letters, 115*(1), 104–107. https://doi.org/10.1016/j.econlet.2011.11.034.

Fai, F. M., & Tomlinson, P. R. (2023). Levelling Up or Down? Addressing Regional Inequalities in the UK. *Contemporary Social Science*, 18(3-4), 285–297. https://doi.org/10.1080/21582041.2023.2282161.

Fazaalloh, A. M. (2019). Is Foreign Direct Investment Helpful to Reduce Income Inequality in Indonesia?. *Economics & Sociology, 12*(3), 25–36. http://dx.doi.org/10.14254/2071789X.2019/12-3/2.

Figini, P., & Görg, H. (2011). Does Foreign Direct Investment Affect Wage Inequality? An Empirical Investigation. *The World Economy, 34*(9), 1455–1475. https://doi.org/10.1111/j.1467-9701.2011.01397.x.

Gam, T. T. H., Oanh, D. L. K., & Dang, N. M. B. (2023). The Impact of Foreign Direct Investment on Income Inequality in Developing Countries: The Bayesian approach. *Jurnal Ekonomi & Studi Pembangunan*, 24(1), 127–143. https://doi.org/10.18196/jesp.v24i1.18164.

Glawe, L., & Wagner, H. (2024). Inflation and Inequality: New Evidence from A Dynamic Panel Threshold Analysis. *International Economics and Economic Policy*, *21*(2), 297–309. https://doi.org/10.1007/s10368-023-00580-x.

Gros, D., & Shamsfakhr, F. (2023). *Inflation and Inequality*. European Union: Economic Governance and EMU Scrutiny Unit.

Hakimi, A., & Hamdi, H. (2017). Does Corruption Limit FDI and Economic Growth? Evidence from MENA Countries. *International Journal of Emerging Markets, 12*(3), 550–571. https://doi.org/10.1108/IJoEM-06-2015-0118.

Handayani, B. D., Yanto, H., Pujiati, A., Ridzuan, A. R., Keshminder, J. S., & Shaari, M. S. (2022). The Implication of Energy Consumption, Corruption, and Foreign Investment for Sustainability of Income Distribution in Indonesia. *Sustainability, 14*(23), 15915. https://doi.org/10.3390/su142315915.

Kuznets, S. (1955). Economic Growth and Income Inequality. *American Economic Review*, *45*(1), 1–28.

Le, Q. H., Do, Q. A., Pham, H. C., & Nguyen, T. D. (2021). The Impact of Foreign Direct Investment on Income Inequality in Vietnam. *Economies*, 9(1), 27. https://doi.org/10.3390/economies9010027.

Ma, X. (2025). Foreign Direct Investment and the Gender Wage Gap: Evidence from China. *International Economics, 184*, 100642. https://doi.org/10.1016/j.inteco.2025.100642.

Malpede, M., & Percoco, M. (2021). Climate Change and Income Inequalities. *Working Paper Series No. 19,* Bocconi University.

Méjean, A., Collins-Sowah, P., Guivarch, C., Piontek, F., Soergel, B., & Taconet, N. (2024). Climate Change Impacts Increase Economic Inequality: Evidence from A Systematic Literature Review. *Environmental Research Letters, 19*(4), 1–24. https://doi.org/10.1088/1748-9326/Ad376e.

Memon, S., & Qureshi, I. A. (2021). Income Inequality and Macroeconomic Instability. *Review of Development Economics*, 25(2), 758–789. https://doi.org/10.1111/rode.12730.

Norris, E. D., Kochhar, k., Ricka, f., Suphaphiphat, N., & Tsounta, E. (2015). *Causes and Consequences of Income Inequality: A Global Perspective*. Washington: International Monetary Fund.

Otrachshenko, V., & Popova, O. (2022). Does Weather Sharpen Income Inequality in Russia?. *Review of Income and Wealth, 68*(1), 193–223. https://doi.org/10.1111/roiw.12532.

http://journal.uinjkt.ac.id/index.php/signifikan
https://doi.org/10.15408/sjie.v15i1.46506

Paddu, A. H., Fattah, S., & Anwar, A. I. (2025). Income Inequality Challenges Economic Stability and Social Cohesion. *International Journal of Environmental Sciences*, 11(7s), 387–394. https://doi.org/10.64252/csvmzx16.

Parsons, E. S., Jowell, A., Veidis, E., Barry, M., & Israni, S. T. (2025). Climate Change and Inequality. *Pediatric Research*, *98,* 1238-1245. https://doi.org/10.1038/s41390-024-03153-z.

Ravinthirakumaran, K., & Ravinthirakumaran, N. (2018). The Impact of Foreign Direct Investment on Income Inequality: A Panel Autoregressive Distributed Lag Approach for the Asia-Pacific Economic Cooperation Developing Economies. *Asia-Pacific Sustainable Development*, 25(1), 57–84.

Sahu, A. K., & Mahalik, M. K. (2024). What Drives More for Macroeconomic Instability-Carbon Inequality or Income Inequality? Panel Evidence from Emerging Economies. *Environment, Development and Sustainability*, 27, 12653–12676. https://doi.org/10.1007/s10668-023-04455-8.

Saucedo, E., Ozuna, T., & Zamora, H. (2020). The Effect of FDI on Low- and High-Skilled Employment and Wages in Mexico: A Study for the Manufacture and Service Sectors. *Journal for Labour Market Research, 54*(1), 9. https://doi.org/10.1186/s12651-020-00273-x.

Shaari, M. S., Esquivias, M. A., Ridzuan, A. R., Zainal, N. F., & Sugiharti, L. (2022). The Impacts of Corruption and Environmental Degradation on Foreign Direct Investment: New Evidence from the ASEAN+3 Countries. *Cogent Economics & Finance, 10*(1), 2124734. https://doi.org/10.1080/23322039.2022.2124734.

Singer, M. (2018). *Climate Change and Social Inequality: The Health and Social Costs of Global Warming*. New Jersey: Routledge.

Suanes, M. (2016). Foreign Direct Investment and Income Inequality in Latin America: A Sectoral Analysis. *Cepal Review*, *118*, 45–61.

Tavares, W. S., Correia, L., Rego, C., & Loiola, T. (2025). Impact of Regional Inequalities on Sustainable Development Strategies in Africa: A Systematic Literature Review Analysis Of Economic, Social, and Environmental Challenges. *European Journal of Sustainable Development Research*, 9(4), 1–11. https://doi.org/10.29333/ejosdr/16772.

Umair, M., Aizhan, A., Teymurova, V., & Chang, L. (2024). Does the Disparity between Rural and Urban Incomes Affect Rural Energy Poverty? *Energy Strategy Reviews*, *56*, 101584. https://doi.org/10.1016/j.esr.2024.101584.

Uspri, B., Karimi, S., Indrawari, I., & Ridwan, E. (2023). The Effect of Inflation on Income Inequality: Evidence from A Non-Linear Dynamic Panel Data Analysis in Indonesia. *Decision Science Letters*, *12*(3), 639–648. http://dx.doi.org/10.5267/j.dsl.2023.4.001.

Vitkovics, R. (2023). Trends in Income Inequality and Its Impact on Economic Growth. *Financial and Economic Review*, *22*(4), 136–159. https://doi.org/10.33893/FER.22.4.136.

Walsh, M. J. P., & Yu, J. (2012). Inflation and Income Inequality: Is Food Inflation Different? *IMF Working Papers* 2012/147, International Monetary Fund.

Zheng, Z., Huang, C. Y., & Wan, X. (2020). Human Capital and Income Inequality in a Monetary Schumpeterian Growth Model. *MPRA Paper* 101912.

http://journal.uinjkt.ac.id/index.php/signifikan
https://doi.org/10.15408/sjie.v15i1.46506