

The Impact of Foreign Investment, Inflation, and Carbon Tax on Economic Growth in Indonesia

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ABSTRACT

One of the main indicators of a country's ability to improve the welfare of its people is its economic growth. However, various macroeconomic factors influence its value. Inflation and Foreign Direct Investment (FDI) have the potential to affect economic stability, while carbon dioxide (CO₂) emissions reflect sustainability aspects that also have a long-term impact. This study aims to analyze the effect of inflation, FDI, and CO₂ emissions on Indonesia's Gross Domestic Product (GDP) in the short and long term. The data used is time series data from 1993 to 2024 with a quantitative approach. The analysis was conducted using multiple linear regression to test partial and simultaneous effects, as well as the Vector Error Correction Model (VECM) method to evaluate long-term relationships and short-term adjustments. Stationarity and cointegration tests were conducted as preliminary steps prior to model estimation. Long-term estimation results show that inflation has a significant negative effect on GDP with a coefficient of -0.0199 and FDI also has a significant negative effect with a coefficient of -1.1383 , while CO₂ emissions have no significant effect. The error correction term value of -0.8852 indicates that short-term imbalances will be corrected towards long-term equilibrium by 88.5% each period. This study emphasizes the importance of macroeconomic policies that can reduce inflation and improve the quality of sustainable foreign investment so that Indonesia's economic growth can be maintained in a stable manner while paying attention to environmental aspects.

Keywords: Economic Growth (GDP), Inflation, Foreign Direct Investment (FDI), CO₂ Emissions.

INTRODUCTION

Gross Domestic Product (GDP) is an important indicator in measuring a country's economic performance. GDP reflects the total value of goods and services produced in a given period, which reflects the level of economic progress and community welfare. However, various macroeconomic and environmental factors can significantly affect GDP growth. Factors such as inflation, foreign investment or foreign direct investment (FDI), and carbon dioxide (CO₂) emissions interact with each other and influence economic growth. The ideal conditions are controlled inflation, increased domestic investment, and minimized carbon emissions so that GDP growth can be optimal and sustainable.

Economic growth theory is determined by increases in labor and capital, with growth limited by resource constraints (Smith, 1776; Ricardo, 1817). High and uncontrolled inflation reduces purchasing power and investment confidence, thereby suppressing economic growth, but moderate and stable inflation can actually support economic stability and

investment (Friedman, 1968). The Kuznets Environmental Curve (EKC) hypothesis states that carbon emissions increase in the early stages of economic growth, but decline once income reaches a certain level due to increased environmental awareness and green technology (Pratama, n.d.).

According to (Ekonomi et al., 2023) on the impact of inflation, FDI, and CO₂ emissions on GDP, it was found that inflation and FDI significantly suppressed Indonesia's economic growth, while carbon emissions were insignificant. Economic growth and FDI with carbon emission levels found that economic growth increased carbon emissions, while FDI tended to reduce them through green investment practices (Agusafeb,+FIKRI+ZULDAREVA, n.d.).

Research (siti aisah, 2023) highlights the impact of FDI, economic growth, and CO₂ emissions in the context of economic crisis and demonstrates the importance of green policies for FDI management in the interest of sustainable development. These findings are consistent with the Kuznets Environmental Curve (EKC) hypothesis, which states that in the early stages of growth, emissions tend to increase, but FDI directed towards green investment can reduce negative environmental impacts.

The current situation points to economic growth, with inflation and FDI negatively affecting economic growth, while carbon emissions have no significant impact or are even controlled thanks to green investment practices and environmental policies. However, there is still a gap in research to simultaneously examine the interaction of these three variables in the context of economic dynamics and green economic policies in Indonesia, particularly in assessing the effectiveness of policies and the role of FDI in the transition to a sustainable green economy.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

1.1 Literature Review

Economic growth is a key indicator of a country's development, which is influenced by various macroeconomic and environmental factors. This literature review explores the effects of inflation, foreign direct investment (FDI), and CO₂ emissions on economic growth in Indonesia. The main theoretical focus uses the frameworks of Paul Romer (endogenous growth) and Robert Lucas (human capital), namely the relationship between long-term economic growth, and then links it to environmental literature (EKC — Environmental Kuznets Curve) and macro literature that studies thresholds/inflation thresholds. Inflation can hamper investment and consumption, FDI brings capital and technology, while CO₂ emissions reflect the trade-off between growth and environmental sustainability. This literature review integrates economic theory and empirical findings to construct an analytical framework.

1.2 Main Theories

In his endogenous growth theory emphasizes that technological innovation born from the activities of researchers and entrepreneurs is the key to long-term economic growth, with ideas as non-rival goods that accelerate the spread of technology, thereby increasing productivity and living standards in a sustainable manner (Jones, 2019).

Meanwhile, Lucas's (1988) model highlights the role of human capital accumulation, obtained through the allocation of time between work and education, as the main driver of sustainable productivity and economic output growth (Diebolt & Le Chapelain, 2019). In other words, economic growth is not only influenced by quantitative factors

such as labor and physical capital, but also significantly by the quality of labor and a country's innovative capabilities, which stem from investment in education, research, and technological development.

The monetarist theory pioneered by Milton Friedman (Ifan Mujiadi et al., 2024) states that inflation is always and everywhere a monetary phenomenon. This means that changes in the money supply are the main cause of inflation. This theory emphasizes that high inflation creates uncertainty, reduces investment, and suppresses growth, in line with the Phillips curve, which shows the trade-off between inflation and unemployment.

The Environmental Kuznets Curve (EKC) hypothesis by Grossman and Krueger (1991) assumes that CO₂ emissions initially increase with economic growth but decline after a certain point due to the adoption of green technology. This theory is relevant because CO₂ is often associated with industrial pollution, which can reduce productivity through health costs and environmental damage.

Finally, according to Hymer's Theory (1960), multinational companies engage in foreign direct investment (FDI) because they have specific advantages that allow them to overcome market barriers and risks associated with overseas operations. FDI is more profitable than exports because it provides full control over resources and operations, and is influenced by factors such as market access, low production costs, and political and economic stability in the destination country.

1.3 Previous Research

Research by (Mustofa & Faizin, 2025) concluded that Indonesia's economic growth is influenced by inflation and foreign direct investment (FDI) with different directions of influence. FDI does not have a significant effect on economic growth, indicating that foreign investment has not been optimal in driving national output growth. Conversely, inflation has a negative effect in the long term, where uncontrolled price increases can suppress purchasing power and productivity.

Research related to the Environmental Kuznets Curve (EKC) hypothesis in Indonesia shows mixed results. (Rahayuningrum, 2024) found that the EKC hypothesis is not proven, where CO₂ emissions and energy consumption have a significant effect on environmental degradation, while economic growth does not show a significant effect. Conversely, (Prasetyanto & Sari, 2021) actually supports the validity of the EKC hypothesis, both in the short and long term, with results showing that economic growth and primary energy consumption have a positive and significant effect on environmental degradation in accordance with the initial phase of the EKC curve.

Meanwhile, according to the study (Siripi et al., 2024) FDI, technological innovation, and economic growth affect carbon emissions in Ghana in different ways. FDI reduces emissions in the short term but increases them in the long term. Technological innovation increases CO₂ emissions, but its interaction with FDI actually reduces emissions, indicating the importance of synchronizing investment and sustainable technology. The findings also support the Environmental Kuznets Curve (EKC) hypothesis, which shows that emissions increase in the early stages of economic growth and then decrease at higher income levels.

1.4 Hypotheses

Based on macroeconomic theory and previous research findings, the hypotheses in this study can be formulated as follows:

1. H1: Inflation has a negative effect on economic growth in Indonesia.
2. H2: Foreign Direct Investment (FDI) has an effect on economic growth in Indonesia.
3. H3: CO₂ emissions have an effect on economic growth in Indonesia.

METHODS

2.1 Operational Definitions

Definisi Operasional dalam penelitian ini merupakan penjabaran dari masing-masing variabel penelitian agar dapat diukur secara nyata dan terobservasi.

- a. The Gross Domestic Product (Y) variable is measured based on the growth rate of Indonesia's Gross Domestic Product (in percent) during the 1990-2024 period as published by the World Bank.
- b. The Inflation variable (X1) is measured based on Indonesia's annual inflation rate (in percent) published by the World Bank.
- c. The Foreign Direct Investment (FDI) variable (X2) is measured based on the growth rate of foreign direct investment inflows into Indonesia per year (in percent) published by the World Bank.
- d. The CO₂ Emissions variable (X3) is measured based on the total amount of carbon dioxide emissions from fuel combustion (in percent) published by Enerdata through the 'CO₂ Emissions from Fuel Combustion' dataset.

2.2 Scope Of Research

This study is limited to several scopes so that the discussion is more focused and in line with the research objectives. Substantively, this study focuses on the influence of Inflation (INF), Foreign Direct Investment (FDI), and Carbon Dioxide Emissions (CO₂) on Gross Domestic Product (GDP) in Indonesia. Spatially, this study is not limited to a specific region because it uses secondary data sourced from official World Bank publications that are national in nature and internationally standardized.

Temporally, the research was conducted using time series data for the period 1990–2024, which was chosen to provide a sufficiently long time frame to observe the dynamics of the relationship between variables. Methodologically, this study uses an associative quantitative approach with multiple linear regression analysis to determine the extent to which inflation, FDI, and CO₂ emissions affect Indonesia's GDP growth. With these limitations, the study is expected to provide a clear, relevant, and measurable picture of the factors that influence Indonesia's economic growth based on empirical data from the World Bank and Enerdata.

2.3 Research Location

The location of this research is not limited to a specific region because it uses national secondary data. The data sources are obtained from official publications of the World Bank and Enerdata, which provide information related to Gross Domestic Product

(GDP), Inflation (INF), Foreign Direct Investment (FDI), and Carbon Dioxide Emissions (CO₂).

The World Bank is used as the main source of macroeconomic data such as GDP, inflation, and FDI, while Enerdata is used as a source of carbon dioxide emission data from fuel combustion. Thus, the research location in this context refers to the data providers, namely the World Bank and Enerdata, rather than a specific geographical location.

2.4 Data Collection Techniques

According to Sugiyono (2019), data collection techniques are the most strategic step in research because the main objective of research is to obtain data. The data collection technique in this study uses secondary data, which is data obtained indirectly through official sources that have been published.

The data used in this study was obtained from the World Bank and Enerdata. The World Bank provides data on Gross Domestic Product (GDP), Inflation (INF), and Foreign Direct Investment (FDI), while Enerdata provides data on Carbon Dioxide (CO₂) emissions from fuel combustion.

In addition, this study also utilizes scientific literature and related publications as supporting data to strengthen the theoretical basis. This technique was chosen because the data used is quantitative, available in the form of official reports, and can be further processed for statistical analysis.

2.5 Data Analysis Techniques

Data analysis in this study uses a quantitative approach with the help of the EVIEWS program, because the data used is in the form of time series. The analysis was conducted to determine the effect of inflation (X₁), Foreign Direct Investment (X₂), and carbon dioxide emissions (X₃) on Gross Domestic Product (Y) in Indonesia. The analysis steps used are as follows:

1. Descriptive Analysis

Used to describe the development of each research variable, namely GDP, inflation, FDI, and CO₂ emissions during the research period.

2. Stationarity Test (ADF Test)

Conducted to ensure that the time series data does not contain unit roots in order to meet the basic assumptions of econometric models.

3. Cointegration Test (Johansen Test)

Used to determine the long-term relationship between variables in the model.

4. Granger Causality Test

To see the direction of the causal relationship between the research variables.

RESULTS

1. Stability Test

Table 1. Unit Root Test Results (ADF)

Varibel	Level	1st Difference	Keterangan
PDB	-4.059293	-	Stasioner pada Level

INF	-	-7.071095	Stasioner pada 1st Difference
FDI	-4.480128	-	Stasioner pada Level
CO ₂	-	-5.414668	Stasioner pada 1st Difference

Source: EViews Data Processing Results

The Augmented Dickey-Fuller (ADF) unit root test was conducted to ensure that all variables were stationary. Based on the test results, the variables GDP, FDI, and CO₂ showed significant results at the level, while the variable Inflation (INF) showed significance at the first difference level. This indicates that all variables are stationary at the same level (level 1), thus fulfilling the requirements for a cointegration test.

2. Johansen Cointegration Test

Table 2. Results of Johansen's Cointegration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.841716	98.37162	47.85613	0.0000
Atmost1*	0.555476	37.54053	29.79707	0.0053
Atmost2	0.258018	10.78572	15.49471	0.2250
Atmost3	0.028010	0.937522	3.841465	0.3329

Source: EViews Data Processing Results

The results of this test show that the Trace Statistic (98.37) exceeds the critical value of 5% (47.85) in the "None" hypothesis. This indicates the existence of a cointegration relationship. Specifically, this test confirms that there are two cointegration equations at a 5% significance level. Thus, it can be concluded that there is a stable long-term relationship between the variables of GDP, Inflation, FDI, and CO₂ Emissions in this model.

3. Determining Lag

Tabel 3. Hasil Uji Lag

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-	NA	0.7355	11.044	11.225	11.1052
	178.2299		07	24	63	7
1	-	134.352	0.0161	7.2156	8.1226	7.52081
	99.05814	1	40	45	19	4
2	-	52.2686	0.00505	6.00748	7.64003	6.5567
	63.12343	7*	5*	1*	4*	85*

Source: EViews Data Processing Results

The results of this lag selection based on the FPE, AIC, and SC criteria show that the best lag is lag 2. This means that the VECM model will be estimated with two lags.

4. VECM Model Estimation

Table 4. Long-Term Estimation Results (VECM Model)

Variabel	Koefisien	t-statistic	Keterangan
INF (-1)	-0.019932	-5.48501	Negatif Signifikan
FDI (-1)	-1.138318	-25.3644	Negatif Signifikan
CO ₂ (-1)	-0.064595	-1.49162	Tidak Signifikan
ECT	-0.885260	-0.92836	Stabil

Source: EViews Data Processing Results

Long-term estimation results show that the variables of Inflation (INF) and FDI have a significant negative effect on GDP, while CO₂ Emissions are not significant. The error correction term (ECT) coefficient value of -0.885260 is significant and theoretical. This value indicates that the adjustment mechanism towards long-term equilibrium is very fast and strong, with long-term equilibrium reaching 88.5% in the following period.

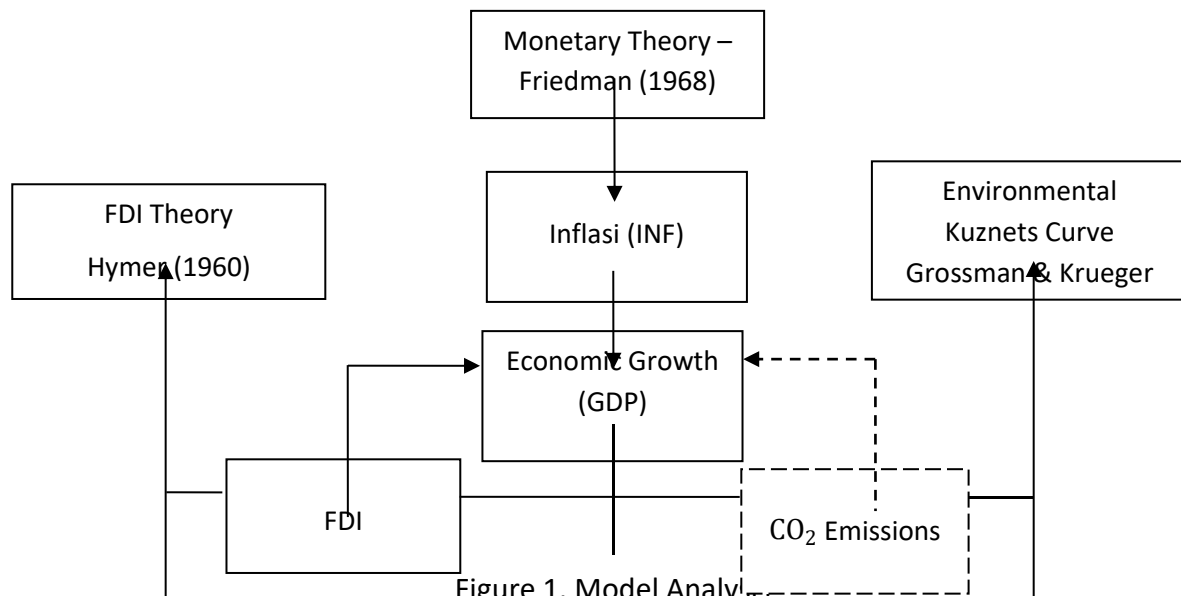


Figure 1. Model Analysis

The framework illustrates the theoretical relationship between variables in this study. Where the variables of Inflation (X1) and FDI (X2) are estimated to have a direct effect on economic growth (Y) based on supporting theories, namely Monetary Theory (Friedman, 1968) and FDI Theory (Hymer, 1960). Meanwhile, CO₂ emissions (X3), which are based on the Kuznets Curve (Grossman & Krueger, 1991), are represented by a dotted line to indicate a potentially nonlinear or uncertain relationship with economic growth. This framework forms the basis of the hypotheses that have been formulated.

Summary of Results

The results of the tests conducted above show that:

The inflation variable indicates Indonesia's long-term economic growth. High price increases can reduce people's purchasing power and productive investment, thereby suppressing GDP. Meanwhile, the Foreign Direct Investment (FDI) variable also has a negative impact on GDP. This may indicate that foreign investment actually has a negative impact on the economy.

However, the results for the CO₂ emissions variable show no significant effect on economic growth, indicating that economic growth in Indonesia during the study period did

not always rely on polluting industries. The results show a value of -0.885260 for the ECT, which means that there is a rapid adjustment process towards long-term equilibrium of around 88% per year.

DISCUSSION

Explanation of Discussion 1 (H1)

The results of the study show that, in the long term, inflation has a negative and significant impact on Indonesia's Gross Domestic Product (GDP), with a coefficient of -0.019. These results support the hypothesis that economic growth is negatively affected by a sustained increase in price levels.

Theoretically, high inflation causes economic uncertainty, which in turn prevents companies from making long-term investment decisions (Mustofa & Faizin, 2025). In addition, unstable inflation can disrupt pricing mechanisms, divert resources from productive activities to speculation, and make capital allocation less efficient, negatively impacting GDP as the real purchasing power of the population declines as a result of increased prices of goods and services.

These results are in line with Indonesian research by (Mustofa & Faizin, 2025), which also found that inflation damages economic growth in the long term. They explain that price increases can reduce people's purchasing power and suppress productive investment, which in turn limits GDP levels. On the other hand, these findings highlight the complexity of macroeconomic relationships. Other studies, such as that conducted by (Duong, 2022) on emerging market countries, show that inflation targeting policies do not always have a significant impact on output growth (GDP) and incentive rates.

These results, in terms of policy, show the importance of the role of monetary authorities in maintaining price stability. Controlling inflation through careful policies is essential to ensure that economic growth can continue without being affected by distortions caused by price spikes.

Explanation of Discussion 2 (H2)

This study also found that, in the long term, Foreign Direct Investment (FDI) has a negative and significant effect on Indonesia's GDP, with a coefficient of -0.1383. This finding is surprising and contradicts the conventional neo-classical economic perspective that considers FDI to be the main driver of economic growth.

This negative coefficient may be due to the fact that during the study period, foreign investment in Indonesia did not fully focus on productive, labor-intensive sectors or sectors with the potential to have a strong spillover effect on the domestic economy. The crowding out phenomenon, whereby FDI displaces or hinders domestic business investment, is one possible mechanism. In addition, FDI that focuses on natural resource extraction or industries with high levels of raw material imports tends to cause income leakage, which reduces the value added calculated in GDP.

In the literature, it has been found that the effects of FDI are not always positive, supporting findings that support these negative results. In their research in Asia, (An & Yeh, 2020) found that the effect of increased FDI growth can only occur when the financial growth rate (FD) is between certain thresholds. Furthermore, at very high levels of FD, the beneficial effects of FDI may diminish or become negative. This provides a theoretical basis for the idea that, in the Indonesian context, conditions or infrastructure, including

institutional and financial development, may have already reached their optimal point. In this case, FDI may become ineffective or even counterproductive.

Although the results show a significant negative, there is contrasting literature, such as (Mustofa & Faizin, 2025), who in their research in Indonesia concluded that FDI is not significant for economic growth, indicating that this relationship is still debatable and depends on the methodology, period, and control variables used.

Explanation of Discussion 3 (H3)

The research results show a coefficient of -0.064595 and a t-statistic of -1.49162 (not significant at $\alpha=5\%$), indicating that CO₂ emissions do not have a significant effect on Indonesia's Gross Domestic Product (GDP) in the long term. This shows that increased economic activity in Indonesia does not always rely on industries that produce a lot of pollution. In other words, Indonesia's economic growth during the research period tended to be driven by the service sector, trade, and domestic consumption rather than heavy industry or fossil fuels, which have the potential to increase CO₂ emissions.

Theoretically, these results support the transition phase of the Environmental Kuznets Curve (EKC) in Indonesia, where GDP growth begins to decouple from high emission intensity due to the shift in economic structure towards more energy-efficient services and domestic consumption.

In contrast to the findings of (Jufri & Bahri, 2022) in Malta, where FDI drives a simultaneous increase in CO₂ and GDP due to the dominance of direct investment in limited sectors in Indonesia, the emission effects of economic activity have been reduced by greater economies of scale, sector diversification, and increased energy efficiency.

Research by (Siripi et al., 2024) in Ghana also shows a similar pattern: although emissions rise in the early stages of growth, the interaction between FDI and technological innovation actually suppresses CO₂ in the long term. The insignificance of CO₂ to GDP indicates that Indonesia is moving towards a phase of green growth, where economic expansion no longer depends on highly polluting industries.

CONCLUSION

This study concludes that macroeconomic and environmental factors play a complex role in determining Indonesia's Gross Domestic Product (GDP) in the long term. Specifically, the results of the VECM model estimation indicate that inflation and Foreign Direct Investment (FDI) both have a negative and significant effect on economic growth. The negative impact of inflation emphasizes the importance of price stability to maintain purchasing power and productive investment, while the negative effect of FDI implies the need for highly selective policies to attract investments that are truly oriented towards technology transfer and create positive spillover effects for the domestic economy, rather than being solely market-oriented.

On the other hand, CO₂ emissions were found to have no significant effect on GDP, indicating that the causal relationship between the environment and the economy in Indonesia is still weak in the long-term context of the study period. The discovery of a significant Error Correction Term (ECT) coefficient confirms the existence of a rapid correction mechanism from short-term imbalances to long-term equilibrium. Further research is strongly recommended to analyze the threshold effect of FDI based on sector or

level of financial development in Indonesia, as well as to explore the role of institutional variables in moderating macroeconomic impacts on growth.

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