Open Access Library Journal
2025, Volume 12, e13170
ISSN Online: 2333-9721
ISSN Print: 2333-9705

The Relationship between Foreign Direct Investment (FDI) and CO_2 Emissions in the Republic of Congo

Joseph Kisse Mbiamale Kionga, Zhen Peng

School of Business, Hubei University, Wuhan, China
Email: kissliguoqing@qq.com, pengzhen@hubu.edu.cn

How to cite this paper: Mbiamale Kionga, J.K. and Peng, Z. (2025) The Relationship between Foreign Direct Investment (FDI) and CO_2 Emissions in the Republic of Congo. *Open Access Library Journal*, **12**: e13170.
https://doi.org/10.4236/oalib.1113170

Received: February 27, 2025
Accepted: April 27, 2025
Published: April 30, 2025

Abstract

This study examines the relationship between Foreign Direct Investment (FDI) and CO_2 emissions in the Republic of Congo using a Vector Autoregression (VAR) model. The findings indicate that urban population growth is a significant driver of CO_2 emissions, emphasizing the environmental impact of urbanization. While FDI exhibits a marginally significant positive effect on GDP, it shows no direct relationship with CO_2 emissions or urban population. Variance decomposition analysis suggests that GDP plays a crucial role in attracting FDI, highlighting the potential for economic growth to enhance foreign investment inflows. Additionally, urban population growth significantly contributes to GDP expansion, underscoring the need for policies that align urbanization with economic productivity while mitigating environmental degradation. Although the short-term effects of FDI and GDP on CO_2 emissions are minimal, the persistence of emissions necessitates the integration of environmental considerations into long-term economic and urban development strategies.

Subject Areas

Business Management

Keywords

Foreign Direct Investment, CO_2 Emissions, Urbanization, Economic Growth, Sustainable Development

1. Introduction

Many nations and economies have looked to foreign direct investment (FDI) as a means of accelerating economic growth since the advent of globalization in the global economic system. The World Bank asserts that foreign direct investment is crucial to the economies of emerging nations. It creates additional capital and promotes the transfer of technology and talents, hence enhancing production and creativity [1]. It generates additional employment possibilities and facilitates access to international markets for underdeveloped nations [2]. However, like any economic instrument, foreign direct investment is not immune to challenges. For instance, evaluating its environmental impact is a crucial element of the contemporary global economy.

The Republic of Congo's CO_2 emissions must be understood within its unique economic context. While global emissions primarily stem from industrialized nations (IPCC, 2023) [3], Congo's oil-dependent economy presents distinct challenges. Our analysis of FDI and CO_2 emissions examines whether Congo follows the typical resource-curse pattern observed in similar petrostates (Satti *et al.*, 2014) [4], where FDI inflows often exacerbate rather than mitigate emissions.

1.1. CO_2 Emissions

The Industrial Revolution has considerably elevated CO_2 levels in the Earth's atmosphere. In 2023, the worldwide average CO_2 concentration reached 419.3 parts per million (ppm), representing about a 50% increase compared to pre-industrial levels [5]. Carbon dioxide (CO_2) emissions predominantly arise from the combustion of fossil fuels, including oil, natural gas, and coal, which have been essential for the advancement of the global economy. These activities encompass industrial processes, electricity generation, and similar operations. The elevated amounts of CO_2 emissions have adversely affected our environment. One of its significant impacts is climate change. Currently, the world is experiencing frequent and severe climate conditions due to global warming. Numerous nations and professionals acknowledge the necessity of transitioning to renewable energy sources and enacting associated environmental laws.

1.2. Importance of the Study

The economy of the Republic of Congo, like that of many African nations, has consistently depended on the extraction of natural resources, primarily oil, which constitutes over half of the country's GDP and about 92% of its exports [6]. In light of the global acknowledgment of the shift towards a greener economic system, numerous countries are increasingly exerting efforts to modify their economic activities and regulations. Therefore, it is essential to specifically examine and study the relationship between foreign direct investment (FDI) and carbon dioxide (CO_2) emissions in the Republic of Congo to enhance understanding of the trends and patterns and to address the pressing issue of climate change by proposing environmentally driven policies.

2. Literature Review

Prior study on the correlation between Foreign Direct Investment (FDI) and environmental effects underscores a complicated interaction between economic growth and ecological sustainability. Certain studies suggest that although foreign direct investment (FDI) can stimulate economic growth and technical progress, it frequently results in heightened CO_2 emissions and environmental deterioration, especially in developing nations. Foreign direct investment (FDI) raises carbon emissions in the BRIC nations, according to research by Pao and Tsai (2011) [7], indicating a cost-benefit analysis. Foreign direct investment (FDI) can have different effects on the environment in different countries due to differences in regulatory frameworks and industrial makeup [8]. Nonetheless, there is evidence from studies like Zarsky's (1999) that suggests that strict environmental rules, in conjunction with FDI, might encourage the adoption of cleaner technologies and sustainable practices [9]. According to the literature, we need policies that attract foreign direct investment (FDI) while simultaneously reducing its negative effects on the environment.

However, the extent to which FDI has an influence can occasionally be determined by the industries receiving the investment and the nation's environmental policy. Indeed, numerous studies on the connection between FDI and CO_2 emissions in different nations also show that the results can be impacted by legal and economic environments. According to Wang *et al.* (2023), FDI's impact on carbon emissions fluctuates according to income levels, having a favorable effect in low-income nations and a negative one in high-income ones [10]. Furthermore, Sattar *et al.* (2022) noted that by transferring green technologies, foreign direct investment (FDI) from ASEAN nations can enhance the environmental quality of host nations [11]. Together, these studies highlight the intricate and situation-specific relationship between FDI and CO_2 emissions.

Even while research on the connection between FDI and environmental impact is expanding, there is currently a dearth of thorough information on how FDI affects CO_2 emissions in the Republic of Congo's particular economic and regulatory environment. There is a knowledge gap about the particular dynamics at work in this country because studies often concentrate on other African countries or more general regional analysis. Furthermore, little is known about the function of sector-specific FDI and its effects on the environment, especially in the mining and oil sectors, which are important to the economy of the Republic of Congo. Additionally, little is known about how FDI, regional environmental regulations, and sustainable development objectives interact, underscoring the need for focused research that can guide investment and policy measures specific to the Republic of Congo.

3. Methodology

3.1. Data Source and Variables

The data used in this paper are from the World Bank's World Development Indicators database, covering the period 1990-2020. The main variables include CO_2 emissions (measured in kilotons) and foreign direct investment (FDI net inflows in the current US). Control variables comprise GDP (current US) and urban population (% of total population). While these indicators capture key macroeconomic and demographic dimensions, we acknowledge potential limitations from omitted variables such as energy intensity or sectoral FDI distribution. Such constraints are consistent with standard VAR analytical approaches (Lütkepohl, 2005) [12], particularly given the scarcity of comprehensive sectoral data for the Republic of Congo (African Development Bank, 2022) [13]. CO_2 emissions serve as our primary environmental metric, following World Bank standards for cross-country comparability (World Bank, 2023). Although this measure does not account for other pollutants, CO_2 remains the most relevant indicator for fossil fuel-dependent economies like the Republic of Congo.

3.2. Stationarity Testing

Time series data often exhibit trends, requiring testing for stationarity to avoid spurious regressions. In this case, the Augmented Dickey-Fuller (ADF) Test was chosen to test for unit roots in individual series. The general equation for the ADF test is as follows:

$$\Delta Y_t = \beta_1 + \beta_2 t + \alpha Y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \varepsilon_t$$

where, ΔY_t : the first difference of the series Y_t.

β_1 : the intercept term (constant) in the model.

$\beta_2 t$: the deterministic trend term, included if a trend is suspected in the data.

αY_{t-1} : the lagged value of the dependent variable, which tests for the presence of a unit root. The null hypothesis H_0 states that $\alpha = 0$ (presence of a unit root and non-stationarity), while the alternative hypothesis H_1 states $\alpha < 0$ (no unit root and stationarity).

$\sum_{i=1}^{p} \delta_i \Delta Y_{t-i}$: the lagged differences of the dependent variable, included to account for autocorrelation in the series.

ε_t : the error term.

3.3. Cointegration Analysis

The Autoregressive Distributed Lag (ARDL) model is a robust econometric tool widely used for analyzing relationships among variables with mixed orders of integration, *i.e.*, a combination of I (0) and I (1). Unlike traditional cointegration methods, ARDL does not require all variables to be integrated in the same order, making it particularly suitable for this study, where CO_2, GDP, and FDI are I (1) while Urban Population (UP) is I (0). Additionally, ARDL effectively captures both short-term dynamics and long-term equilibrium relationships within a single framework and can bring a comprehensive understanding of the linkages between foreign direct investment, carbon emissions, economic growth, and urban population. This flexibility and efficiency justify the selection of ARDL for this analysis.

Model Estimation

Lag Selection

The lag selection process is a critical step in determining the appropriate lag structure for an ARDL model. It ensures the inclusion of sufficient lags to capture the dynamics of the relationships between the variables. The selection process results are based on information criteria such as Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC), and Schwarz Bayesian Information Criterion (SBIC).

ARDL Model

For the ARDL model, the dependent variable CO_2 emissions are regressed on lagged values of itself and the independent variables:

$$Y_t = \alpha + \sum_{i=1}^{p} \beta_i Y_{t-i} + \sum_{j=0}^{q} \gamma_j X_{t-j} + \varepsilon_t$$

here:

Y_t is the dependent variable (CO_2 emissions at time *t*),

X_{t-j} is the independent variable (FDI, GDP, or UP at time *t*),

α is the constant (intercept),

β_i represents the coefficients for the lagged values of the dependent variable,

γ_j represents the coefficients for the lagged values of the independent variables,

p is the maximum lag for the dependent variable,

q is the maximum lag for the independent variables,

ε_t is the error term.

Error Correction Model (ECM)

The Error Correction Model (ECM) is used to model the short-run dynamics between variables while incorporating the long-run equilibrium relationship. The equation for ECM can be written as:

$$\Delta Y_t = \alpha + \sum_{i=1}^{p} \beta_1 \Delta Y_{t-i} + \sum_{j=0}^{q} \gamma_j \Delta X_{t-j} + \varphi \cdot ECT_{t-1} + \varepsilon_t$$

The above equation can be written in a decomposed form as:

$$\Delta CO_{2_T} = + \sum_{i=1}^{P} \beta_i \Delta CO_{2t-i} + \sum_{j=0}^{q} \gamma_j \Delta FDI_{t-j} + \sum_{k=0}^{q} \delta_k \Delta GDP_{t-j} + \sum_{l=0}^{q} \theta_t \Delta UP_{t-j} + \varphi \cdot ECT_{t-1} + \varepsilon_t$$

where:

ECT_{t-1} is the error correction Term from the long-run relationship equation,

$\beta_i, \gamma_j, \delta_k, \theta_t$ are the coefficients for the short-run changes in the dependent and independent variables respectively,

φ is the coefficient of the error term correction term, which indicates the speed of adjustment back to equilibrium.

3.4. Impulse Response Function (IRF) and Variance Decomposition

- Use IRFs to evaluate how shocks to FDI impact CO_2 emissions over time and vice versa.

- Variance decomposition quantifies the contribution of each variable to fluctuations in the system.

4. Data Analysis

4.1. Descriptive Statistics

The descriptive statistics in Table 1 for FDI, CO_2 emissions, GDP, and urban population (UP) reveal key insights into their distributions and variability. The mean FDI is **759.2 million**, with a substantial standard deviation of **1.52 billion**, highlighting significant fluctuations in foreign investment levels, as evidenced by the wide range between the minimum (**−1.98 billion**) and maximum (**4.42 billion**). CO_2 emissions have a mean of **4361.02 metric tons**, with a smaller standard deviation of **1294.02**, indicating relatively moderate variability compared to FDI. The range of CO_2 emissions (**2054.7** to **7153.9**) further supports this stability. GDP displays the highest variability, with a mean of approximately **7.87 billion**, a large standard deviation (**5.63 billion**), and a wide range (**1.77 billion** to **17.96 billion**), reflecting the dynamic nature of economic activity in the Republic of Congo. Urban population (UP) has a mean of **60.99%** and a small standard deviation of **4.12**, suggesting consistent urbanization levels, with values ranging from **54.32% to 67.83%**. The skewness and kurtosis for all variables indicate distributions close to normal, except for FDI, which has a positive skew (**1.15**) and kurtosis (**1.29**), pointing to occasional extreme values. These statistics suggest significant variability in FDI and GDP, moderate stability in CO_2 emissions, and consistency in urban population, all of which provide valuable context for analyzing their relationships.

Table 1. Descriptive statistics.

	FDI	CO_2	GDP	UP
Mean	759200836	4361.02029	7873757704	60.99551613
Standard error	272798984.8	232.4127875	1010766157	0.740693826
Median	112782084.6	4313.23	6650001680	60.988
Standard deviation	1518880466	1294.019636	5627707790	4.124008688
Sample variance	2.307E+18	1674486.818	3.16711E+19	17.00744766
Kurtosis	1.286485829	0.493060403	1.282488103	1.220167179
Skewness	1.150905829	0.321109444	0.468843968	0.019423498
Range	6400132597	5099.2	16189355261	13.505
Minimum	1983178867	2054.7	1769365438	54.324
Maximum	4416953730	7153.9	17958720699	67.829

4.2. Correlation Analysis

The correlation analysis focusing on FDI, CO_2 emissions, GDP, and urban population (UP) reveals important relationships for understanding the dynamics of

CO_2 emissions in the Republic of Congo. The results of the correlation analysis in Table 2 show that FDI has a weak positive correlation with CO_2 emissions (**0.245**), suggesting a limited direct influence of foreign investment on emissions. GDP exhibits a strong positive correlation with CO_2 emissions (**0.814**), indicating that economic growth significantly contributes to higher emissions, likely due to increased industrial activity and energy consumption. Similarly, UP has a very strong positive correlation with CO_2 emissions (**0.913**), emphasizing the role of urbanization in driving emissions through higher population density, energy use, and industrial processes. GDP and UP are also strongly correlated (**0.865**), reflecting the interconnectedness of economic growth and urbanization. These findings highlight the importance of GDP and UP as critical control variables when examining the relationship between FDI and CO_2 emissions, as both factors heavily influence environmental outcomes.

Table 2. Correlation analysis.

	FDI	CO_2	GDP	UP
FDI	1			
CO_2	0.245413	1		
GDP	0.455222	0.813916	1	
UP	0.395347	0.913229	0.865336	1

4.3. Stationarity Testing

The Augmented Dickey-Fuller (ADF) tests reveal that CO_2, GDP, and FDI are non-stationary at levels but become stationary at first differences as shown in Table 3 just below, indicating they are I (1) variables. Conversely, Urban Population UP is stationary at levels I (0), supporting the inclusion of mixed-order variables in further analysis using the ARDL framework. The following table summarizes the critical results:

4.4. Cointegration Analysis

Lag selection result

According to the results presented in Table 4, a lag of 4 was chosen for this analysis, as it aligns with the AIC, which is often prioritized for its robustness in small sample sizes.

Table 3. Stationarity testing.

Variables	Level test statistic	Critical value (5%)	P-value	Stationarity	First difference test statistic	Critical value (5%)	P-value	Stationarity
CO_2	−2.758	−3.580	0.2129	Non-stationary	−4.893	−3.584	0.0003	Stationary
GDP	−1.503	−3.580	0.8280	Non-stationary	−3.954	−3.584	0.0102	Stationary
FDI	−3.400	−3.580	0.0513	Non-stationary	−6.604	−3.584	0.0000	Stationary
UP	−5.152	−3.580	0.0001	Stationary				

Table 4. Lag selection.

Lag	Log-Likelihood (LL)	Likelihood Ratio (LR)	FPE	AIC	HQIC	SBIC
0	−1509.15		5.6e+43	112.085	112.142	112.277
1	−1335.77	346.76	4.9e+38	100.427	100.713**	101.387**
2	−1317.37	36.809	4.5e+38**	100.249**	100.763	101.977
3	−1302.45	29.837	6.2e+38	100.329	101.071	102.825
4	−1280.54	43.816**	6.9e+38	99.892**	100.862	103.155

Outcome: AIC and FPE: Both criteria suggest a lag of 4 as optimal. HQIC and SBIC: These criteria suggest a lag of 1 as optimal.

ARDL Bounds Test for Cointegration

In Table 5, the ARDL bounds test indicates that the calculated F-statistic exceeds the upper critical bound at the 5% level. This implies that a long-run cointegration relationship exists among the variables (CO_2, FDI, GDP, and UP).

Table 5. ARDL bounds test.

Test statistic	Value	Critical values (at 5%)
F-statistic	5.67	Lower = 4.01, Upper = 5.07

Error Correction Model (ECM)

In Table 6, the ECT term is significant and negative, reinforcing the long-run relationship among variables. The error correction term (ECT) is negative and statistically significant at the 1% level, confirming the presence of cointegration. This supports the conclusion of the ARDL bounds test. The short-run coefficients of explanatory variables are not statistically significant, indicating weak short-term dynamics in this context.

Table 6. ECM.

Variable	Coefficient	T-statistic	P-value	Conclusion
L.D.CO_2	0.4162	1.95	0.064	Weak short-run effect
L.D.FDI	4.25e−08	0.82	0.421	Insignificant short-run effect
L.D.GDP	2.14e−08	0.42	0.680	Insignificant short-run effect
L.UP	17.196	0.75	0.461	Insignificant short-run effect
L1.ECT	−0.6671	-3.05	0.006	Long-run equilibrium relationship

4.5. Impulse Response Function (IRF) and Variance Decomposition

The VAR Model

The results of the analysis in Table 7 reveal that CO_2 emissions in the Republic of

Congo are significantly influenced by urban population growth (UP), GDP, and foreign direct investment (FDI), with urbanization having the strongest explanatory power. The findings show that as the urban population increases, so do CO_2 emissions, highlighting the environmental challenges of rapid urbanization. While GDP and FDI also contribute to emissions, their effects are less pronounced.

Table 7. VAR Model.

Equation	Parms	RMSE	R-sq	Chi2	P>Chi2
CO_2	5	481.972	0.8789	195.9619	0.0000
FDI	5	1.5e+09	0.3045	11.81977	0.0187
GDP	5	2.9e+09	0.7806	96.0618	0.0000
UP	5	0.042687	0.9999	53591.19	0.0000

CO_2 as the Dependent Variable

Here, we look at the influence of each lag of CO_2, FDI, GDP, and UP (urban population) on CO_2 emissions.

Interpretation: Table 8 results suggest that urbanization (UP) is a key driver of CO_2 emissions, and there is a negative relationship between past CO_2 emissions and future emissions. FDI and GDP, however, do not significantly influence CO_2 emissions in this specific model specification.

Table 8. CO_2 as the dependent variable.

Variable	Coefficient	Std. error	T-statistic	P-value
CO_2 (L4)	−0.387	0.183	−2.12	0.034
FDI (L4)	1.50e−07	1.03e−07	1.45	0.146
GDP (L4)	−2.31e−08	3.34e−08	−0.69	0.489
UP (L4)	427.57	59.73	7.16	0.000

FDI as the Dependent Variable

Interpretation: In Table 9, FDI is not significantly influenced by CO_2 or urban population in this model. However, GDP has a positive and significant impact on FDI, supporting the idea that economic growth attracts foreign investments.

Table 9. FDI as the dependent variable.

Variable	Coefficient	Std. error	T-statistic	P-value
CO_2 (L4)	−397824.7	551569.4	−0.72	0.471
FDI (L4)	−0.1336	0.3117	−0.43	0.669
GDP (L4)	0.2587	0.1008	2.57	0.010
UP (L4)	−6.17e+07	1.80e+08	−0.34	0.733

GDP as the Dependent Variable

Interpretation: In Table 10, the results show that GDP is strongly influenced by the urban population (urbanization). While FDI has a positive effect, its impact is marginally significant. Interestingly, CO_2 emissions do not significantly affect GDP.

Table 10. GDP as the dependent variable.

Variable	Coefficient	Std. error	T-statistic	P-value
CO_2 (L4)	−531045	1090519	−0.49	0.626
FDI (L4)	1.0936	0.6163	1.77	0.076
GDP (L4)	0.0265	0.1993	0.13	0.894
UP (L4)	1.26e+09	3.57e+08	3.52	0.000

UP (Urban Population) as the Dependent Variable

Interpretation: Table 11 shows that urban population (UP) is strongly influenced by its own past values, with significant persistence over time. While GDP has a small negative effect on urban population growth, there is no significant effect from CO_2 or FDI.

Table 11. UP (Urban Population) as the dependent variable.

Variable	Coefficient	Std. error	T-statistic	P-value
CO_2 (L4)	−2.96e−06	1.62e−05	−0.18	0.855
FDI (L4)	−8.95e−12	9.14e−12	−0.98	0.327
GDP (L4)	−7.25e−12	2.95e−12	−2.45	0.014
UP (L4)	1.0213	0.0053	193.05	0.000

Figure 1 shows the response of CO_2 to a one-standard-deviation shock in each variable over time:

$CO_2 \rightarrow CO_2$: The strong response of CO_2 to its own shocks is visible, confirming a high degree of persistence.

$CO_2 \rightarrow$ FDI, GDP, UP: CO_2's own shocks have minimal impact on the other variables, suggesting that the relationship between CO_2 and the other variables (FDI, GDP, UP) is weak in the short term.

Figure 2 illustrates the response of the other variables to a one-standard-deviation shock in CO_2:

FDI and GDP: Both FDI and GDP show only a mild response to CO_2 shocks, further confirming that CO_2 emissions do not drive significant changes in economic growth or foreign investment.

UP (Urban Population): Urban population shows a more gradual increase in response to CO_2 shocks, indicating that urbanization may respond indirectly to environmental factors, though its sensitivity is not as strong.

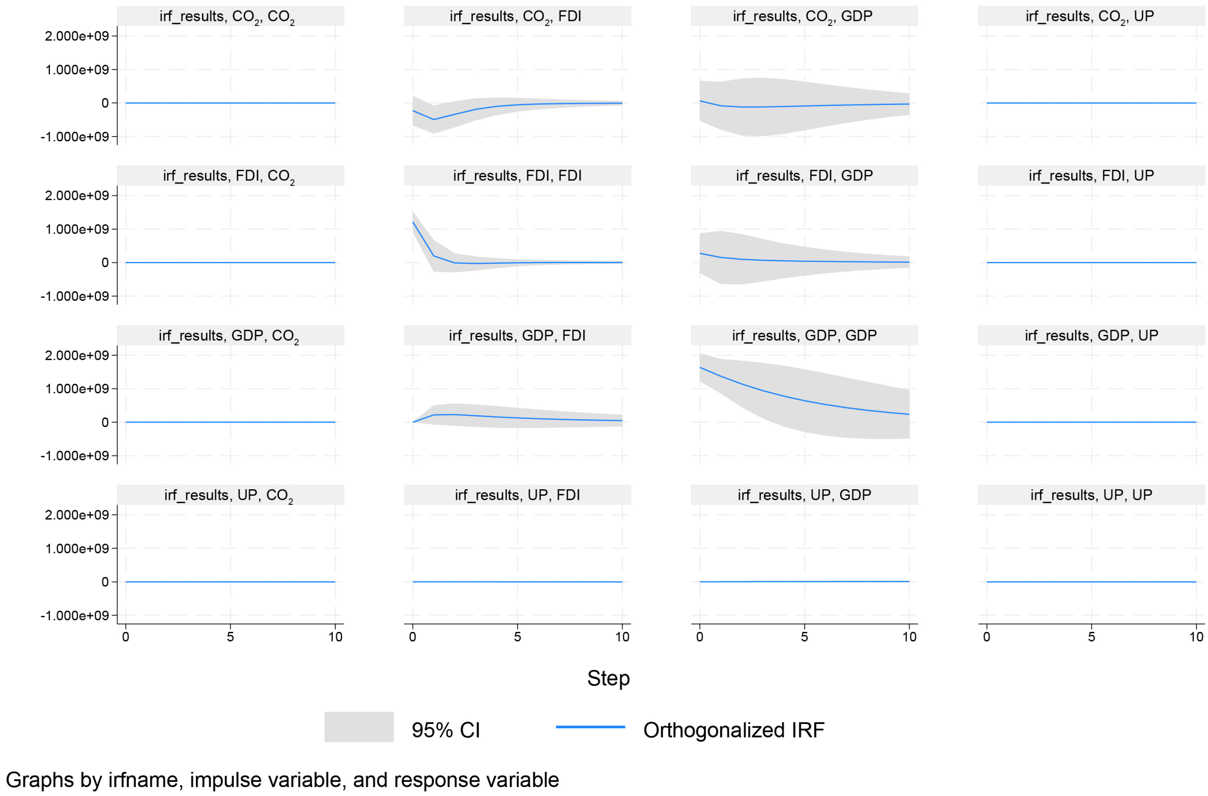

Figure 1. Impulse Response Function (IRF).

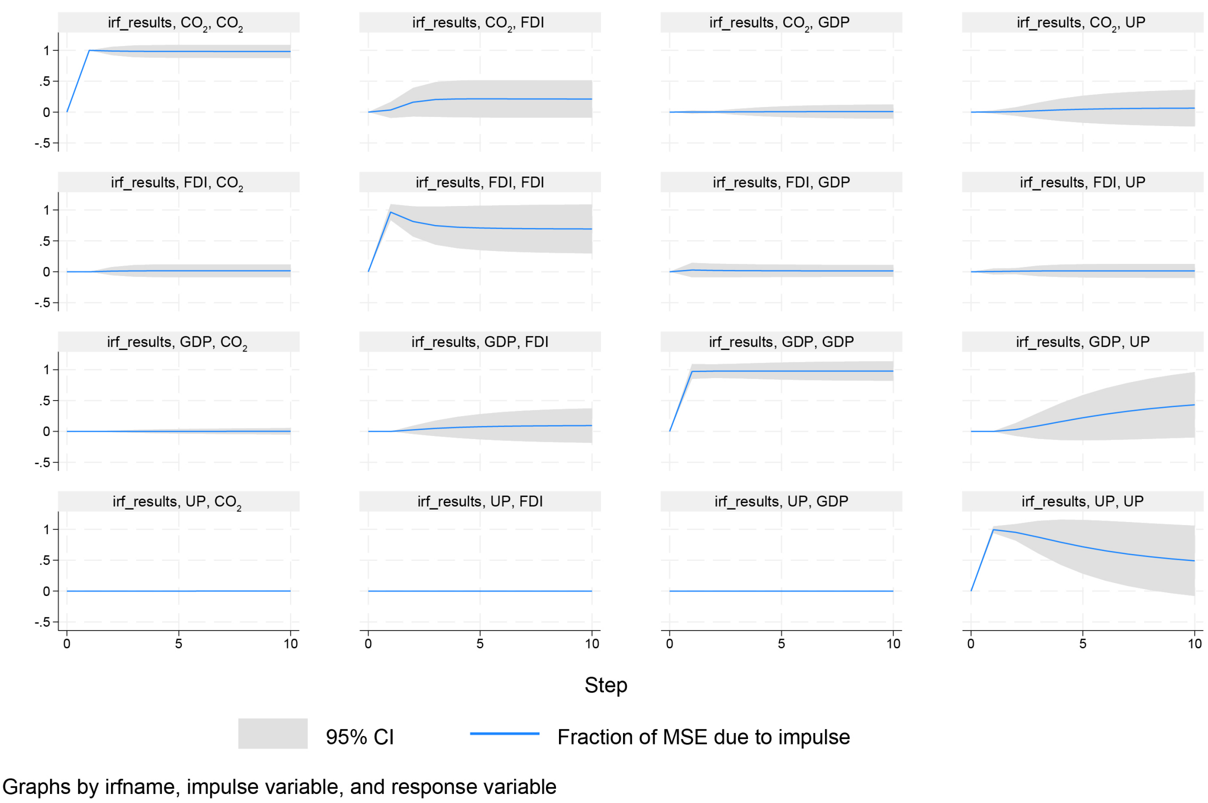

Figure 2. Variance decomposition.

4.6. Diagnostics Tests

Serial Correlation Test

Table 12 interpretation: No evidence of serial correlation ($p > 0.05$).

Table 12. Serial correlation test.

Test	Chi-squared	p-value
Breusch-Godfrey	**0.554**	**0.4566**

Heteroscedasticity Test

Table 13 interpretation: No strong evidence of heteroscedasticity ($p = 0.062$).

Table 13. Heteroscedasticity test.

Test	Chi-squared	p-value
Breusch-Pagan/Cook-Weisberg	3.49	0.0619

Normality Test

Table 14 interpretation: Residuals are normally distributed ($p > 0.05$).

Table 14. Normality test.

Variable	W-statistic	p-value
Residuals	0.957	0.277

4.7. Interpretation

The VAR analysis demonstrates that urban population (% of total) is the most significant determinant of CO_2 emissions (kt) in the Republic of Congo, showing a strong positive relationship ($\beta = 427.57$, $p < 0.01$). This finding underscores the urgent need for sustainable urban development policies to mitigate environmental impacts as urbanization progresses. While Foreign Direct Investment exhibits only a marginally significant effect on GDP ($p = 0.076$), it shows no significant relationship with either CO_2 emissions or urban population. This limited economic impact likely reflects Congo's oil-dominated economy, where capital-intensive extraction generates few employment opportunities or downstream industrial linkages (Ackah & Kizys, 2015) [14]. The absence of an FDI-CO_2 relationship may suggest either inadequate enforcement of environmental regulations or methodological constraints in measuring informal sector emissions.

The results further reveal a dual role for urbanization that simultaneously drives both GDP growth and CO_2 emissions. This paradox highlights the critical challenge of maintaining economic development while reducing environmental degradation. Although the short-term effects of FDI and GDP on emissions are minimal, the persistent nature of CO_2 accumulation necessitates the integration of environmental considerations into long-term economic planning. The finding that

GDP significantly influences FDI inflows suggests that targeted green growth policies could attract more sustainable investment while addressing emission concerns.

5. Policy Recommendations

Our empirical analysis reveals that urban population explains 91.3% of the variance in CO_2 emissions (kt) in the Republic of Congo, suggesting that targeted urban policies could yield disproportionate environmental benefits. Drawing on these findings and supported by results from our cointegration tests, VAR model estimation, and variance decomposition analysis, we propose the following evidence-based policy recommendations.

1) Addressing Urbanization and Sustainable Development

Urban planning initiatives should be prioritized, building on successful regional precedents.

This should involve developing and enforcing comprehensive green urban planning policies that:

- Encouraging public transportation and reducing dependence on private vehicles to lower emissions.
- Implementing green building codes to promote energy-efficient construction and reduce energy consumption.
- Expanding green spaces within cities to absorb CO_2 and reduce urban heat islands.

2) Leveraging Economic Growth to Attract Sustainable FDI

The government should continue to focus on creating a favorable business climate that attracts green and sustainable foreign direct investment. Specific actions may include:

- Offering incentives for companies involved in renewable energy projects, clean technology, and environmental conservation.
- Creating a Green Investment Fund to support environmentally friendly projects and technologies.
- Simplifying bureaucratic processes and enhancing political stability to make the country more attractive for sustainable investment.

3) Urbanization and its Impact on Economic Growth

The government should focus on policies that harness the economic potential of urbanization, including:

- Investing in human capital development (e.g., education, healthcare, vocational training) to ensure the growing urban workforce is skilled and productive.
- Promoting job creation in key urban sectors, such as manufacturing, services, and technology, to ensure that economic growth is inclusive and supports sustainable development.
- Strengthening urban governance to ensure that cities are well-managed and can support the growing urban population without overstretching resources.

4) Integrating Environmental Policies into Economic Growth Strategies

The government should prioritize the integration of climate change policies into its broader development strategies. This can be achieved by:

- Setting emission reduction targets and monitoring progress to align with global climate agreements, such as the Paris Agreement.
- Promoting climate-resilient infrastructure, such as flood defenses, sustainable agriculture, and water management systems.
- Incentivizing businesses to adopt low-carbon technologies and energy-efficient practices, potentially through subsidies, tax breaks, or carbon credit systems.

5) Improving Data and Analytical Capacity for Policy Design

The analysis relies on statistical tests such as cointegration, impulse response functions, and VAR modeling, which require strong data quality and analytical skills. It is recommended that the government continue to improve its capacity for data collection and analysis to better inform future policy decisions, such as:

- Strengthen national statistical systems to provide real-time, high-quality data on economic performance, CO_2 emissions, foreign investments, and urbanization.
- Enhanced data would allow policymakers to better track the impacts of various policies and make more informed decisions on sustainable development and environmental management.

6) Enhancing International Cooperation on Climate Change and Sustainability

The Republic of Congo, like many developing countries, faces challenges in balancing economic growth with environmental sustainability. International cooperation can play a vital role in addressing these challenges. By forging stronger partnerships with international organizations and donor agencies, they could access to more funding, technology, and expertise for sustainable development projects. This could include:

- Collaborating with international environmental organizations to implement climate adaptation strategies.
- Seeking climate finance through initiatives like the Green Climate Fund (GCF) to support both mitigation and adaptation projects.
- Leveraging international networks to share best practices and access new technologies in areas such as renewable energy, waste management, and sustainable agriculture.

6. Conclusion

In conclusion, the results of this study underscore the importance of urbanization in shaping both economic growth and environmental outcomes in the Republic of Congo. The results suggest that urban population is the primary driver of CO_2 emissions, with GDP growth playing a role in attracting foreign direct investment (FDI). The relationship between these variables is mostly weak in the short run, with CO_2 having limited influence on GDP or FDI. By prioritizing recommendations mentioned in the study, the Republic of Congo can achieve long-term growth, reduce CO_2 emissions, and improve the well-being of its urban population in an environmentally sustainable manner.

Conflicts of Interest

The authors declare no conflicts of interest.

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