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Financial Sector - Foreign Direct Investment-Carbon Emissions Nexus in Selected African Countries

Kunofiwa Tsaurai[1]

Abstract: Using dynamic generalized methods of moments (GMM), pooled ordinary least squares (OLS), fixed effects and random effects with panel data ranging from 2005 to 2018, this study had two main objectives. Firstly, to investigate the impact of financial development and or foreign direct investment on carbon emissions in selected African countries. Secondly, explore the influence of the complementarity between financial development and foreign direct investment on carbon emissions in selected African countries. Financial development was found to have had positively and significantly influenced carbon emissions in selected African countries under the dynamic GMM only. Foreign direct investment's impact on carbon emissions was observed to be negative and significant also under the dynamic GMM approach. Across all the four econometric methods used in this study, the complementarity between financial development and foreign direct investment had a significant negative influence on carbon emissions in selected African countries. African countries need to ensure that its financial sector avails loans and financial resources towards promoting the use of clean energy and acquisition of new efficient technology that emits less carbon dioxide. They also need to implement policies which attracts foreign investors which are environmentally friendly in their day to day manufacturing and industrial activities. Further studies need to investigate threshold levels above which financial development begins to significantly increase carbon emissions in selected African countries. Future studies can also examine the threshold levels above which foreign direct investment begins to significantly reduce carbon emissions in selected African countries.

Keywords: Financial Sector; Foreign Direct Investment; Panel Data; Selected African Countries

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[1] Professor, Department of Finance, Risk Management and Banking, University of South Africa, Address: P.O. Box 392, UNISA 0003, Pretoria, South Africa, Corresponding author: tsaurk@unisa.ac.za.

1. Introduction

Background and introduction of the study: Carbon emissions from industrial and manufacturing activities have got a deleterious effect on not only the welfare of human beings but on the economy at large (Zou & Zhang. 2020; Piaggio & Padilla. 2012; Mazzanti et al. 2006). Although carbon emissions trap heat and keep the earth warm in order to sustain the life of human beings, Olubusoye et al (2020) argued that excess emissions of carbon leads to excess land surface temperatures which are not good for human life. Excess carbon emissions result in the earth's climate becomes more warmer far much more than normal levels, hence leading to what is known as climate change. The latter instigates flooding due to a correspondent rise in sea levels, rainfall decline overally negatively affects agriculture, which is a vital cog in the economic development processes (Kivyiro & Arminen. 2014).

The impact of carbon emissions on economic growth is no a debatable issue in the field of economics and finance. In other words, the carbon emissions-growth nexus is now a settled issue in the literature as there is abundant evidence to explain the carbon emissions led negative economic growth relationship. The use of such knowledge for policy making decision purposes is limited unless empirical research on the determinants of carbon emissions is done (Tsaurai, 2019). It is against this background that this study investigates the impact of financial development and foreign direct investment on carbon emissions in selected African countries. Such a study helps selected African to develop and implement financial development and foreign direct investment policies which are geared towards reducing carbon emissions for the overall good of economic growth.

Financial development -carbon emissions nexus and the impact of foreign direct investment on carbon emissions has so far been empirically researched by several authors. The similarities between these two different sets of research work are as follows: Firstly, they produced mixed results (see section 2 and 3). This prompted the author to further carry out an empirical investigation on the subject matter using selected African countries as a unit of analysis. Secondly, majority of the empirical studies wrongly assumed a linear relationship between the variables. Thirdly, majority ignored the endogeneity problem inherent in the relationship between (1) financial development and carbon emissions and (2) foreign direct investment and carbon emissions. Fourthly, majority did not capture the dynamic characteristics of carbon emissions data. Fifthly, majority of them used old and outdated data. Sixthly, none of them investigated the influence of the complementarity between financial development and foreign direct investment on carbon emissions. This study fills in all these gaps.

Contribution of the study: There are six different ways in which this study contributes towards literature. Firstly, unlike other previous similar research work, this study acknowledged that the relationship between carbon emissions and its

explanatory variables is non-linear. Secondly, this study is different from other similar studies because it uses the most recent data (2005 to 2018). Thirdly, this study is more conclusive because it used four different panel data analysis methods (dynamic GMM, fixed effects, pooled OLS, random effects) for comparison purposes. Fourthly, this study captured the dynamic characteristics of carbon emissions data using the dynamic GMM approach, unlike other prior similar research on the subject matter. Fifthly, using the dynamic GMM, this study effectively addressed the endogeneity problem which other general panel data analysis approaches cannot solve. Sixthly, this is the first study according to the author's best knowledge to investigate the impact of a complementarity between financial development and foreign direct investment on carbon emissions. Although it is spelt out in the literature (Ngonadi et. al. 2020) that the complementarity effect of the two variables reduces carbon emissions, no dedicated empirical study has so far tried to prove or disapprove such a theoretical assertion to the author's best knowledge.

Structure of the paper: The remaining part of the study is split into six sections. Section 2 discusses both the theoretical and empirical literature on the impact of financial development on carbon emissions. Section 3 focuses on the influence of foreign direct investment on carbon emissions from both a theoretical and empirical literature viewpoint. Section 4 discusses other determinants of carbon emissions included in this study. Section 5 is the research methodology, results presentation, analysis and interpretation. Section 6 is the concluding paragraph. Section 7 is the bibliography.

2. Impact of Financial Development on Carbon Emissions–Literature Review

According to Aye and Edoja (2017), financial development increases the magnitude of manufacturing activities in the economy through availing loans and financial assistance to local firms seeking to expand. The increase in the quantity of manufacturing activities leads to pollution and increased carbon emissions. Xing et al (2017) also noted that the availability of credit enables people and small to medium scale enterprises to buy automobiles and machinery, which uses a lot of energy and emit more carbon dioxide.

By attracting foreign direct investment, financial development indirectly increases the emissions of carbon dioxide into the air. This is because foreign direct investment activities increase the scale of economic activities and levels of energy usage in the economy (Aye and Edoja. 2017). On the contrary, the financial development induced foreign direct investment can spearhead research activities into clean energy programmes thereby helping to reduce the amount of carbon emissions.

Yuxiang and Chen (2010) argued that financial sector can be a vital cog in providing financial help needed by local firms to invest in the purchase of efficient technology which reduces the quantity of carbon dioxide emissions. The view was supported by Frankel and Rose (2012) whose study argued that the efficient allocation of financial resources to local firms is vital in enabling them to acquire technology which is environmentally friendly.

Table 1. Influence of Financial Development on Carbon Emissions – A summary of Recent Empirical Literature

Author	Country/Countries of study	Period	Methodology	Results
Zhang (2011)	China	1980-2008	Granger causality analysis	Financial development was found to have had a significant positive causal effect on carbon emissions in China
Jiang and Ma (2019)	155 countries globally	1990-2014	Dynamic GMM	From a global, emerging and developing countries perspective, financial development had a significant positive effect on carbon emissions. Financial development was found to have an insignificant positive impact on carbon emissions in developed countries.
Shoaib et al (2020)	Developed and developing countries	1999-2013	Autoregressive Distributive Lag (ARDL)	In both long and short run, financial development had a significant positive influence on carbon emissions under both groups of countries.
Tsaurai (2019)	Africa	2003-2014	Panel data analysis	Financial depth was observed to have had a significant causal effect on carbon emissions in Africa
Gok (2020)	Global	Primary studies on existing literature	Primary studies on existing literature	Financial development induced carbon emissions was observed.
Omri et al (2015)	Middle East and North African (MENA) countries	1990-2011	Panel data analysis	No causal relationship was observed between financial development and carbon emissions in the MENA region
Toyin (2017)	Sub-Saharan Africa	1989-2012	Static and dynamic panel data analysis methods	Financial development reduced carbon emissions in upper middle-income countries whilst it increased carbon emissions in low income countries, low to middle income

				countries and in high income countries.
Kwakwa (2020)	Global perspective	Literature review analysis	Literature review analysis	Carbon emissions are granger caused by financial development, among other key factors that influences it.
Xiong and Qi (2018)	Chinese provinces	1997-2011	Panel data analysis methods	Financial development was found to have had a reduction effect on per capita carbon emissions in China.
Hasan et al (2021)	Bahrain	1980-2018	Vector Error Correction Model (VECM)	Financial development Granger caused carbon emissions in both short and long run.

Source: Author compilation

It is evident that the impact of financial development on carbon emissions is far from reaching consensus in the field of commerce, economics and finance. The empirical literature results on the effect of financial development on carbon emissions are mixed, divergent and inconclusive. This triggered this attempt to further empirically investigate the relationship between the two variables.

3. Impact of Foreign Direct Investment on Carbon Emissions -Brief Literature Review

Just a recap, Blanco et al (2013) argued that the amount of carbon emissions and pollution generating manufacturing activities goes up in direct response to increase in foreign direct investment inflow into the country. The view supports the findings by Cheng and Yang (2016) whose study noted that foreign direct investment led to a reduction in carbon emissions only up to a certain minimum threshold level beyond which it led to a steady rise in the quantity of carbon emissions in China.

Table 2. Impact of Foreign Direct Investment on Carbon Emissions – Empirical Literature

Author	Country/Countries of study	Period	Methodology	Results
Kaya et al (2017)	Turkey	1974-2010	Vector Autoregressive approach	The relationship between foreign direct investment and carbon emissions were found to be defined by a U-shape.
Mahadeva and Sun (2020)	China	Literature review based	Panel data analysis	China's outward FDI was found to have reduced carbon emissions especially in the Eastern regions.
Wang et al (2021)	China	2004-2016	Panel data analysis	A non-linear relationship was detected in China in as far as the relationship between FDI and carbon emissions is concerned.
Chenran et al (2019)	Laos	1990-2017	Time series data analysis	A U-shape relationship described the relationship between FDI and carbon emissions in Laos.
Marques and Caetano (2020)	High and middle income countries	2001-2017	Panel autoregressive distributive lag	FDI had a significant positive impact on carbon emissions across high to middle-income countries.
Ngonadi et al (2020)	Sub-Saharan Africa	2004-2015	Generalized Methods of Moments (GMM)	A significant positive relationship running from FDI towards carbon emissions was detected in Sub-Saharan Africa
Eriandani et al (2020)	ASEAN countries	1980-2018	Panel data analysis	Carbon emissions per capita was significantly positively affected by FDI in Asean countries studied.
Sung et al (2018)	China	2002-2015	System GMM method	FDI reduced carbon emissions across Chinese provinces
Sasana et al (2018)	Indonesia	1985-2018	Time series data analysis	FDI increased the amount of carbon emissions in Indonesia
Huang et al (2019)	Chinese provinces	1997-2014	Panel data analysis	A U-shape informed the relationship between foreign direct investment and carbon emissions in Chinese provinces.

Source: Author compilation

It is clear from both the theoretical and empirical literature discussion on the impact of FDI on carbon emissions that any study on the determinants of carbon emissions which leave out FDI is premised not only to ail but leads to inconclusive results.

4. Other Determinants of Carbon Emissions

This section discusses the other factors which affect carbon emissions, namely population growth, economic growth, renewable energy, natural resources extraction and trade openness.

Increased population growth, according to Aye and Edoja (2017) increases the amount of energy usage in daily economic activities and deforestation activities. The study therefore expects population to have a positive impact on carbon emissions. Population growth (annual %) is used as a proxy of population growth in this study.

Aye and Edoja (2017) noted that the usage of clean energy to enhance economic growth overally leads to lower carbon emissions per capita. Aye and Edoja (2017) however also argued that high levels of economic growth requires the usage of more energy and carbon emissions in order to sustain it. The study generally expects economic growth to have a positive influence on carbon emissions. Gross domestic product (GDP) per capita is used as a measure of economic growth in this study.

Consistent with Tsaurai (2019), renewable energy consumption reduces carbon emissions because it is clean. The percentage of total final energy consumption is used as a measure of renewable energy consumption in this study.

According to Kwakwa (2020), the heavy machinery used in the extraction of natural resources produces a lot of pollution, uses a lot of energy and in the process emit large quantities of carbon dioxide. This study therefore expects carbon emissions to be positively affected by extraction of natural resources. The proxy of natural resources used in this study is the total natural resources rents (% of GDP).

High levels of trade openness enable firms to easily acquire state of the art technology which is very efficient in the energy consumption and carbon emissions (Grossman and Krueger. 1991). The same author also noted that high levels of trade openness promotes large scale manufacturing activities in the economy thereby increasing the amount of carbon emissions generated from these industrial economic activities. This study expects trade openness to influence carbon emissions either way. Total trade (% of GDP) is the proxy of trade openness used in this study.

5. Research Methodology, Presentation and Discussion of Results

This section describes data used, general and econometric model specification, panel unit root tests, panel co-integration and main data analysis using panel data methods.

5.1. Data Used and Its Description

Panel data spanning from 2005 to 2018 was used in this study. Carbon emissions is the dependent variable used whilst independent variables include financial development, foreign direct investment, trade openness, economic growth, population growth, renewable energy and natural resources. World Bank Development Indicators, African Development Bank, International Financial Statistics are the international and reputable databases from which secondary data

was extracted. Southern African countries included are South Africa, Namibia, Zimbabwe and Botswana. North African countries included in the study are Egypt, Morocco, Tunisia and Algeria. Ghana, Nigeria, Senegal and Mali are the West African countries included in the study. East Africa is represented by Kenya, Eritrea, Comoros and Rwanda. Central African countries that are part of the study include Cameroon, Central African Republic, Democratic Republic of Congo and Gabon.

5.2. Model Specification of the Study

Equation 1 represents a general model specification describing the determinants of carbon emissions in this study.

CBE =f(FIN, FDI, OPEN, POP, GROWTH, NATURAL, RENEW) [1]

Where CBE stands for carbon emissions, FIN represents financial development whilst FDI is foreign direct investment. OPEN, GROWTH, RENEW, POP and NATURAL respectively stands for trade openness, economic growth, renewable energy usage, population growth and natural resources extraction.

Empirical research on a similar subject matter to a larger extent informed the choice of these explanatory variables used in this study. These include Kaya et al (2017), Mahadeva and Sun (2020), Wang et al (2021), Chenran et al (2019), Marques and Caetano (2020), Ngonadi et al (2020), Eriandani et al (2020), Sung et al (2018), Sasana et al (2018) and Huang et al (2019), among others.

Population growth (annual %), GDP per capita, total trade (% of GDP), total natural resources rents (% of GDP), renewable energy consumption (% of total final energy consumption) and carbon emissions (metric tons per capita) were used as measures of population growth, economic growth, trade openness, natural resources extraction, renewable energy use and carbon emissions respectively. The choice of measures of these variables was also in line with the available empirical literature on the subject matter.

Equation 2 is an econometric format representing the carbon emissions and its explanatory variables.

$$CBE_{it} = \beta_0 + \beta_1 FIN_{it} + \beta_2 FDI_{it} + \beta_3 OPEN_{it} + \beta_4 POP_{it} + \beta_5 GROWTH_{it} + \beta_6 NATURAL_{it} + \beta_7 RENEW_{it} + \varepsilon \quad (2)$$

Table 3. The Interpretation of Variables in Equation 2

i	Country
t	Time
β_0	Intercept term
β_0	Intercept term
β_1 to β_4	Co-efficient of independent variables
Ɛ	Error term
CBE_{it}	Carbon emissions in country i at time t
FIN_{it}	Financial development in country i at time t
FDI_{it}	Foreign direct investment in country i at time t
$OPEN_{it}$	Trade openness in country i at time t
POP_{it}	Population growth in country i at time t
$GROWTH_{it}$	Economic growth in country i at time t
$NATURAL_{it}$	Natural resources extraction in country i at time t
$RENEW_{it}$	Renewable energy usage in country i at time t

Source: Author compilation

The impact of the complementarity effect (between financial development and foreign direct investment) on carbon emissions in line with Ngonadi et al (2020) is captured in equation 3 below.

$$CBE_{it} = \beta_0 + \beta_1 FIN_{it} + \beta_2 FDI_{it} + \beta_3 (FIN_{it} \,.\, FDI_{it}) + \beta_4 OPEN_{it} + \beta_5 POP_{it} + \beta_6 GROWTH_{it} + \beta_7 NATURAL_{it} + \beta_8 RENEW_{it} + Ɛ \quad (3)$$

In this study, equation 3 is econometrically estimated using fixed effects, random effects and pooled ordinary least squares, consistent with other similar empirical studies such as Eriandani et al (2020), Wang et al (2021), Xiong and Qi (2018) and Omri et al (2015), among others.

$$CBE_{it} = \beta_0 + \beta_1 CBE_{it-1} + \beta_2 FIN_{it} \; \beta_3 FDI_{it} + \beta_4 (FIN_{it} \,.\, FDI_{it}) + \beta_5 OPEN_{it} + \beta_6 POP_{it} + \beta_7 GROWTH_{it} + \beta_8 NATURAL_{it} + \beta_9 RENEW_{it} + Ɛ \quad (4)$$

Equation 4 introduced the lag of carbon emissions in order to capture the dynamic processes of carbon emissions in line with the reality (Jiang & Ma. 2019:5). The advantage of introducing the lag of carbon emissions into the regression equation 4 is that it enhances the credibility of the regression results by dealing away with the influence of uncontrollable variables (Jiang & Ma, 2019). The dynamic GMM approach was used to econometrically estimate equation 4 because it effectively addresses the endogeneity problem and avails effective estimators.

5.3. Panel Unit Root Tests

The results of panel unit root tests are presented in Table 4.

Table 4. Panel Root Tests – Individual Intercept

	Level			
	LLC	**IPS**	**ADF**	**PP**
LCBE	-3.18*	-5.64*	4.92	7.01
LFIN	-3.89***	-2.42**	65.17**	78.49***
LFDI	-3.58***	-4.58***	-3.16***	-7.37***
LOPEN	-2.17***	-1.48***	57.18**	76.13***
LPOP	-4.11***	-4.27***	91.49**	101.37***
LGROWTH	-1.38	1.43	32.67	67.93**
LNATURAL	-3.84***	-2.18***	57.35***	103.02***
LRENEW	-1.28*	-1.77*	34.04**	42.19***
	First difference			
LCBE	-12.18**	-21.73**	57.29**	74.02*
LFIN	-10.23***	-9.41***	140.19***	262.92***
LFDI	-6.28***	-9.83***	-7.30***	-17.11***
LOPEN	-11.82***	-12.01***	191.05***	400.33***
LPOP	-10.69***	-11.82***	178.97***	631.57***
LGROWTH	-8.37***	-9.25***	152.04***	293.02***
LNATURAL	-11.44***	-14.87***	158.42***	503.92***
LRENEW	-7.49***	-9.15***	108.17***	299.39***

*Note: LLC, IPS, ADF and PP stands for Levin, Lin and Chu; Im, Pesaran and Shin; ADF Fisher Chi Square and PP Fisher Chi Square tests respectively. *, ** and *** denote 1%, 5% and 10% levels of significance, respectively.*

Source: Author's compilation - E-Views figures

In line with other empirical research (Aye and Edoja. 2017; Tsaurai. 2019; Wang et al. 2021), this study used four different panel unit root testing methods such as Levin et al (2002), Im et al (2003), PP Fisher Chi Square and Augmented Dicky Fuller Fisher Chi Square tests. All variables used in this study were stationary at first difference or integrated of order 1 to borrow from Mugableh (2015) terminology.

5.4. Panel Co-Integration Tests

Kao (1999)'s approach was used to establish whether a long run relationship exists between and among the variables studied (see results in Table 5).

Table 5. Results of Kao Co-Integration Tests

Series	ADF t-statistic
CBE FIN FDI OPEN POP GROWTH NATURAL RENEW	-3.0002***

Source: Author compilation

A long run relationship was found to have existed between and among the variables under study at one percent level of significance. In other words, the null hypothesis which says a long run relationship exist among the variables under study could not be rejected at one percent level of significance, in line with Tembo's (2018) interpretations. These results allowed main data analysis to continue.

5.5. Data Analysis, Results Description and Interpretation

For results comparison purposes, four econometric estimation approaches were used in this study, namely the dynamic GMM, fixed effects, random effects and pooled ordinary least squares (see results in Table 6).

Table 6. The Carbon Emissions Function -Panel Data Results Presentation

	Dynamic GMM	Fixed effects	Random effects	Pooled OLS
CBE_{it-1}	0.1901***	-	-	-
FIN	0.1799*	-0.0187	-0.1525	-0.2183
FDI	-0.2167*	-0.2188	-0.0003	-0.4437
FIN.FDI	-0.0015***	-0.0918*	-0.2739**	-0.3317***
OPEN	0.1153*	0.3427*	0.1176	0.3278*
POP	0.1892***	0.5528**	0.0016**	0.2762**
GROWTH	0.3276***	0.0901***	0.3318	0.1482
NATURAL	0.1739**	0.0007	0.1562	0.4478
RENEW	-0.0054**	-0.47721**	-0.0326*	-0.2759**
Adjusted R-squared	0.62	0.61	0.57	0.59
J-statistic/F-statistic	153	67	63	47
Prob(J-statistic/F-statistic)	0.00	0.00	0.00	0.00

***, ** and * denote 1%, 5% and 10% levels of significance, respectively.

Source: Author's compilation from E-Views

From Table 6, it is clear that the lag of carbon emissions had a significant positive impact on carbon emissions under the dynamic GMM approach. The results are in line with Jiang and Ma (2019) whose study noted that carbon emissions are dynamic in nature. Financial development under the dynamic GMM had a significant positive effect on carbon emissions, consistent with Aye and Edoja (2017) whose study argued that financial development increases the magnitude of manufacturing activities in the economy through availing loans and financial

assistance to local firms seeking to expand thereby increasing the quantity of manufacturing activities leads to pollution and increased carbon emissions. Fixed effects, random effects and pooled OLS show that financial development had a non-significant negative influence on carbon emissions. This means that financial development reduced carbon emissions in an insignificant manner, in line with Aye and Edoja (2017)'s argument that financial development induced foreign direct investment can spearhead research activities into clean energy programmes thereby helping to reduce the amount of carbon emissions.

FDI's impact on carbon emissions was found to be negative but significant under the dynamic GMM whilst a non-significant negative relationship running from FDI towards carbon emissions was observed under random effects, fixed effects and pooled OLS approaches. These results mean that FDI reduced carbon emissions, consistent with Sung et al (2018) whose study produced results which show that FDI reduced carbon emissions across Chinese provinces. The complementarity between financial development and foreign direct investment was observed to have had a significant negative influence on carbon emissions across all the four econometric estimation methods. The results mean that the complementarity variable significantly reduced carbon emissions, in line with Ngonadi et al (2020) whose argument is that the availability of financial resources towards researching and inventing new efficient and clean energy dilutes the quantity of carbon dioxide emitted by foreign direct investment related manufacturing activities.

The impact of trade openness on carbon emissions was found to be positive and significant under the dynamic GMM, fixed effects and pooled OLS methods whilst random effects shows a non-significant positive relationship running towards carbon emissions from trade openness. The results show that trade openness increased carbon emissions, in line with Grossman and Krueger (1991) whose study argued that high levels of trade openness promote large scale manufacturing activities in the economy thereby increasing the amount of carbon emissions generated from these industrial economic activities.

Across all the four econometric estimation methods, population growth had a significant positive influence on carbon emissions, in support of Aye and Edoja's (2017) findings which stated that an increase in population growth increases the amount of energy usage in daily economic activities, deforestation activities and carbon emissions.

A significant positive impact of economic growth on carbon emissions was observed under the dynamic GMM and fixed effects whilst both random effects and pooled OLS shows that economic growth had a non-significant positive effect on carbon emissions. These results mean that economic growth increases the amount of carbon emissions, in line with Aye and Edoja (2017)'s findings which says that high levels

of economic growth requires the usage of more energy and carbon emissions in order to sustain it.

Natural resources under the dynamic GMM approach had a significant positive influence on carbon emissions whilst it had a non-significant positive impact on carbon emissions under the pooled OLS, random and fixed effects methods. The results are in line with Kwakwa (2020) whose study argued that heavy machinery used in the extraction of natural resources produces a lot of pollution, uses a lot of energy and in the process emit large quantities of carbon dioxide.

Consistent with majority of literature on the subject matter, renewable energy usage had a significant negative effect on carbon emissions across all the four econometric methods employed in this study. This means that renewable energy usage reduces the amount of carbon emissions, in line with Tsaurai (2019) whose study noted that renewable energy consumption reduces carbon emissions because it is clean.

6. Concluding Paragraph

Using dynamic generalized methods of moments (GMM), pooled ordinary least squares (OLS), fixed effects and random effects with panel data ranging from 2005 to 2018, this study had two main objectives. Firstly, to investigate the impact of financial development and or foreign direct investment on carbon emissions in selected African countries. Secondly, the explore the influence of the complementarity between financial development and foreign direct investment on carbon emissions in selected African countries. Financial development was found to have had positively and significantly influenced carbon emissions in selected African countries under the dynamic GMM only. Foreign direct investment's impact on carbon emissions was observed to be negative and significant also under the dynamic GMM approach. Across all the four econometric methods used in this study, the complementarity between financial development and foreign direct investment had a significant negative influence on carbon emissions in selected African countries. African countries need to ensure that its financial sector avails loans and financial resources towards promoting the use of clean energy and acquisition of new efficient technology that emits less carbon dioxide. They also need to implement policies which attracts foreign investors which are environmentally friendly in their day to day manufacturing and industrial activities. Further studies need to investigate threshold levels above which financial development begins to significantly increase carbon emissions in selected African countries. Future studies can also examine the threshold levels above which foreign direct investment begins to significantly reduce carbon emissions in selected African countries.

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