SUSTAINABLE ENERGY SUPPLY, INSTITUTIONAL QUALITY AND FOREIGFN DIRECT INVESTMENT IN WEST AFRICA

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Abstract

Foreign direct investment (FDI), is regarded as one of the most important contributors of economic growth. However, West Africa is one of the most corrupt of any region in the world which affect the inflows of foreign direct investment into the region. Hence, the study examined the impact of sustainable energy supply, institutional quality and foreign direct investment in West Africa. The study sampled the entire West African countries. Secondary data was employed sourced from the World Development Indicator covering the period of 2000 to 2021. The study employed dynamic panel Generalized Method of Moments (GMM) estimator, cross-sectional auto-regressive distributed regression (ARDL) and Dumitrescu and Hurlin Panel Causality Tests. The findings from the study showed that access to electricity (β = 2.0311*; p < 0.01) have a positive influence on foreign direct investment. The study also revealed that electricity production (β =* .7028*; p < 0.01) have significant impact on foreign direct investment. The study further revealed that rule of law (β =* 3.450*; p < 0.01) is a significant determinant of foreign direct investment. It was also revealed that: control of corruption (β =*.0998*; p < 0.01) has significant impact on foreign direct investment. Finally, the study revealed that electricity production and foreign direct investment had uni-directional causality. The study concluded that energy supply and institutional quality have impact on foreign direct investment to West African countries. The study recommended that governments of various nations in West Africa countries should improve on the level of investment in the energy sector as energy supply is seen as a major cause of having low attraction of foreign direct investment in the region. In addition, government should strengthen the quality of their institutions such as the rule of law, political stability, control of corruption, government effectiveness, and voice and accountability, thereby reducing the risk of foreign investors and increase the level of foreign direct investment in West Africa.*

Keywords: Sustainable energy supply, Institutional Quality, Foreign Direct Investment

Introduction

The role of investment, particularly foreign direct investment (FDI), is regarded as one of the most important contributors of economic growth. Many countries, especially developing countries, see FDI as an important element in their overall strategy for economic development. The importance of Foreign Direct Investments (FDI) is seen as crucial and a top priority for policy makers. According to the IMF and OECD definitions, direct investment reflects the aim of obtaining a lasting interest by a resident entity of one economy (direct investor) in an enterprise that is resident in another economy (the direct investment enterprise).

Furthermore, sustainable energy supply means a structure that generates, transmits or stores electricity, natural gas, refined petroleum products, renewable fuels, coal and coal products, wood fuels, geothermal sources, radioactive material and other resources yielding energy. The availability of electricity, however, is highly unequal, resulting in dependency on unsustainable natural resources limiting social capabilities, resilience and sustainability for more than 2 billion people in developing countries and less developed countries. Accordingly, access to modern energy services is a foundation for sustainable development and one that has recently become a foremost international and national priority. Energy supply drove industrialization, western standards of living and recently 680 million people from poverty in China (Birol 2021). These are available sources of electricity supply that helps to improve the economic condition of developing countries by providing adequate distribution of power supply that helps improve industrialization, improve the standard of living and as well reduce poverty in the country.

Foreign investors rely on access to sufficient energy supply to attract financial capital (Chaurey, *et.al*, 2020). In addition, reliable, adequate, and high-quality infrastructure enhances economic productivity, decreases production expenses, elevates the nation's regional and global competitiveness, and facilitates the influx of foreign investments. UNCTAD (2023) states that enhanced infrastructural facilities play a crucial role in promoting intra-regional trade and investment, hence facilitating the growth of regional markets.

Institutional quality on the other hand, is a multidimensional concept that refers to the quality of a country's political and economic institutions, including the rule of law, government effectiveness, regulatory quality, control

of corruption, and political stability (Kaufmann, Kraay, & Mastruzzi, 2011). Institutional quality is a critical determinant of economic growth, as it affects the allocation of resources, the efficiency of markets, and the incentives for innovation and entrepreneurship (Acemoglu & Robinson, 2019). In addition, institutional quality is crucial for social development and political stability, as it promotes trust, accountability, and social cohesion (Okunmadewa & Akinlo, 2017).

West Africa countries are endowed with abundant energy resources but continuously suffer from perennial energy crisis which has defied solution. According to Oyaromade, Mathew and Abalaba (2021), the power sub-sector has remained erratic for almost a decade with promises of massive increase in generation capacity from successive governments in the region. This has significantly reduces the level of foreign direct investment in the region and productive activities in the region are attributed to huge investment gap in every sector. Attempts at economically utilizing the huge flared gas in the region have also not been reasonable.

Furthermore, Kolawole, Abdulmumin, Gizem, Seyingbo and Abdulrauf (2023), opined that West Africa have been bedeviled by the twin economic crises of mounting energy crises and foreign direct investment inadequacies. The amount of FDI inflow into Africa rose to $54 billion in 2014, however, declined up till 2017. It increased to US$46 billion in 2018 and further declined by 16% in 2020 (World Bank, 2022). According to UNCTAD's World Investment Report (2023), foreign direct investment (FDI) flows to Africa declined to $45 billion in 2022 from the record $80 billion set in 2021. Similarly, the cost of sending money from abroad to West Africa is almost two times higher than what it cost to transfer funds to any other part of the world (World Bank, 2020).

Furthermore, Parks, Buntaine and Buch (2017) has emphasized on the need for strong institutional quality to guarantee financial inflows, growth and development. The basic impediment to Africa economic progress and improved foreign financial inflows is the uncertainty and manipulation of the judicial system, corruption, bribery, ill-defined property rights and the existence of inefficient institutions as ill-conceived arrangements cause those countries to be risky and unattractive for foreign investors (Luiz, 2019).

Several studies (such as Chen and Jiang, 2022) on energy supply on financial flows considered access to electricity while neglecting electricity production. Similarly, the previous studies focused on Sub-Sahara Africa while ignoring it

effect on West Africa as a region. It is on this bases that necessitated the need for this study.

Literature Review

Foreign Direct Investment

According to the International Monetary Fund (IMF) (2015), direct investment reflects the aim of obtaining a lasting interest by a resident entity of one economy (direct investor) in an enterprise that is resident in another economy (the direct investment enterprise). The "lasting interest" implies the existence of a long-term relationship between the direct investor and the direct investment enterprise and a significant degree of influence on the management of the latter. Direct investment involves both the initial transaction establishing the relationship between the investor and the enterprise and all subsequent capital transactions between them and among affiliated enterprises, both incorporated and unincorporated. Oke and Adeusi (2012) asserted that there are both private and public foreign investments. Private investment is further divided into direct and indirect (portfolio investments). Public Foreign Investment refers to the investment of foreign government and governmental agencies funds in the economy of a developing nation. Here the foreign government places some investments on both capital terms in the developing countries which may bring about its development. This can be done by financing the projects directly (direct investment) or through an agent in the developing country (indirect investment) who finances the project on behalf of the foreign government.

Private Foreign Investment refers to the investment of private foreign funds in the economy of a developing nation, usually in the form of import substituting industries by multinational corporations (MNCs). The MNCs carry with them technologies of production, tastes and style of living managerial services, diverse business practices, including co-operative arrangements, marketing restrictions, advertising and transfer pricing (Okereocha, 2016).

Institutional Quality

Institutional quality is a critical determinant of economic growth, as it affects the allocation of resources, the efficiency of markets, and the incentives for innovation and entrepreneurship. The rule of law is one of the key indicators of institutional quality, as it provides the legal framework for economic and social activities. The rule of law is characterized by impartial and effective

enforcement of laws, protection of property rights, and access to justice. In countries with weak rule of law, property rights are often insecure, contracts are difficult to enforce, and corruption is prevalent (Acemoglu & Robinson, 2012). In Africa, the rule of law is a major challenge to institutional quality, as the judicial system is slow and inefficient, and there is a lack of trust in the impartiality of judges.

Government effectiveness is another critical indicator of institutional quality, as it determines the capacity of the government to provide public goods and services, regulate economic activities, and implement policies (Kaufmann et al., 2011). Government effectiveness is determined by the quality of public administration, the level of public sector capacity, and the degree of political stability. In Africa, government effectiveness is constrained by the lack of skilled personnel, weak coordination among government agencies, and political interference in decision-making.

Regulatory quality is also an essential component of institutional quality, as it affects the business environment, investment climate, and competition. Regulatory quality refers to the extent to which regulations are transparent, efficient, and effective in achieving their objectives. In Africa, regulatory quality is hampered by the complexity of regulations, lack of clarity in regulatory roles and responsibilities, and weak enforcement mechanisms (World Bank, 2020).

Political stability and absence of violence is another crucial indicator of institutional quality, as it provides the necessary conditions for economic growth, social development, and political participation. Political instability and violence create uncertainty, increase transaction costs, and undermine public trust in government (Okunmadewa & Akinlo, 2017). In Africa, political instability and violence are significant challenges to institutional quality, as evidenced by the Boko Haram insurgency, ethnic and religious conflicts, and election-related violence (World Bank, 2020).

Control of corruption is another important indicator of institutional quality, as corruption erodes public trust, undermines economic growth, and impedes development (Kaufmann et al., 2011). In Africa, corruption is pervasive and affects all levels of government and society, hindering the effectiveness of institutions and the delivery of public services. This reflects the prevalence of corrupt practices, such as embezzlement, bribery, and nepotism, which are often tolerated or even accepted as part of the political culture (Adeyemi, 2019).

Weak rule of law is another crucial factor that undermines institutional quality. The rule of law ensures that all individuals and institutions are subject to the same laws and regulations, and that justice is impartially and effectively administered (Kaufmann et al., 2011). In many developing countries, the rule of law is weak and unevenly enforced, leading to a lack of confidence in the legal system and hindering economic development (Okunmadewa & Akinlo, 2017).

In addition, political instability and weak democratic institutions can also undermine institutional quality. In many African countries, political power is concentrated in the hands of a small elite, and democratic institutions are weak and vulnerable to manipulation. This can lead to social unrest, civil conflict, and economic instability, as well as a lack of accountability and transparency in government (Acemoglu & Robinson, 2012). Overall, the quality of institutions is crucial for sustainable development and economic growth, as well as for maintaining political stability and social cohesion.

Sustainable Energy Supply

Energy supply has been statutorily defined by the International Renewable Energy Agency (IRENA), ratified by 108 members (107 states and the European Union) as of February 2013: “energy includes all forms of energy produced from renewable sources in a sustainable manner, including bioenergy, geothermal energy, hydropower, ocean energy, solar energy and wind energy.” The International Energy Agency (IEA) defines renewable energy resources as those “derived from natural processes” and “replenished at a faster rate than they are consumed” (IEA 2002, OECD, IEA and Eurostat, 2005). The IEA definition of renewable energy includes the following sources: “electricity and heat derived from solar, wind, ocean, hydropower, biomass, geothermal resources, and biofuels and hydrogen derived from renewable resources” (IEA 2002).

Theoretical Review

The Eclectic Theory

This theory as postulated by Dunning (1973) seeks to offer a general framework for determining patterns of both foreign owned production undertaken by a country‘s own enterprises and that of domestic production owned by foreign enterprises. According to Dunning (1973), there are two types of investments that a firm can chose to undertake. That is, Foreign

Portfolio Investment (FPI) and Foreign Direct Investment (FDI). FPI is defined as the passive holdings of securities and other financial assets, which do not entail active management or control of securities issuer. FPI is positively influenced by high rates of return and reduction of risk through geographical diversification. The return of FPI is normally in the form of interest payments or non-voting dividends (Dunning, 1973). The eclectic theory is launched in three pillars of Ownership, Location and Internalization (O+L+I). The three pillars are different questions that foreign investors seek to answer. The 'O' pillar comprises of the ownership advantages that addresses the question why the foreign firms need to go abroad.

According to Dunning (1985), this question hypothesizes that foreign firms have one or more firm specific advantages which allows them to overcome operating costs in a foreign country. The ownership advantages include core competency, brand name and economies of scale amongst others. The 'L' pillar addresses the question of location. According to Dunning (1985), the decision of the firm to move offshore is based upon the firm specific advantage in conjunction with factors in a foreign country. Factors such as land and labour are important in determining the location of a Multinational Enterprise (MNE) in order for it to make profits. Dunning (1985) further asserts that the choice of investment location depends on several complex calculations that include economic, social and political factors to determine whether investing in that country is profitable or not. The 'I' pillar represents the internalization advantages on how to go abroad. The MNE have several options to choose from in their entry mode in a foreign country. Choices range from the arm's length transactions (market) to the hierarchy (wholly owned subsidiary). The MNE can choose internalization if the market does exist or functions poorly, that is transaction costs of the external route are high. Under the firm specific advantage, an MNE operating a plant in a foreign country can be faced with a number of additional costs in relation to their local counterparts (local competitor).

Empirical Review

Chen *et.al.* (2024). examined the relationship between Foreign Direct Investment (FDI), economic growth, and institutional quality to maintain sustainable energy efficiency in BRICS. The objective of the study is to decompose which elements collectively impact the uptake of sustainable energy practices. A comprehensive dataset and an advanced econometric model Data Envelopment Analysis (DEA) are employed to investigate the dynamics at play. the analysis incorporates institutional quality, providing a

fresh perspective on the impact of this factor on FDI and economic development in the BRICS economies. Findings show the crucial position FDI holds in developing sustainable energy and the institutional structure's effectiveness in accomplishing the current objectives. We have kept the position of economic growth, which serves as the essential driver for environmentally friendly use of energy resources. Our results have shown that FDI in sustainable energy is a requisite for economic growth improvement and the need for such progress to be supported by effective institutions to facilitate intra-regional investments.

Saidi, Montasser and Ajmi (2019) examined the relationship between renewable energy and economic growth in MENA countries taking into account institutional measures. The study Used panel cointegration tests and covered the period of 1986 to 2015, the study found that renewable energy, economic growth, and any institutional measures are cointegrated. Furthermore, the study also found a strong causality running from renewable energy and any institutional measure, except law and order, to growth.

Immaculate and Patricia (2021) investigated the cointegrating and causality relationships between foreign direct investment (FDI), foreign portfolio investment (FPI) and institutional quality in a sample of 12 emerging market economies for the period from 2007 to 2017. A composite index for institutional quality composed of the Worldwide Governance Indicators was constructed using the Principal Components Analysis (PCA) method. The panel autoregressive distributed lag (ARDL) model and the error correction model (ECM) were applied to assess the cointegrating and causal relationships between the key variables. The results further suggested that the long-run relationship between the two foreign capital inflows was more of a trade-off nature, dependent upon the dynamics of the institutional environment in the host economy. The recommendations suggested include that emerging markets should continue to open their economies in pursuit of capital inflows, which will reciprocally strengthen their domestic institutional environment.

Joshua *et.al* (2023) the research study investigates how institutional quality conditions energy consumption to influence private capital inflows in Africa using data from 1990 to 2019. The paper employed a modified dynamic system GMM. Our results show that energy consumption has a direct influence on private capital inflows, particularly FDI to Africa. Institutional qualities do not directly influence the effect of energy consumption on FDI but do influence the effect on portfolio investment. However, independently, institutional quality positively motivates FDI inflows into Africa. On the contrary, the

reverse analysis showed that private capital inflows do not influence energy consumption in Africa

Anasuya and Narayan (2021) investigates the role of institutional quality in moderating the impact of energy consumption on CO2 emission, with other variables such as trade, capital formation, FDI, financial development and population in 39 developing countries for 1995– 2017. The mean group (MG), augmented mean group (AMG), common correlated effects mean group (CCEMG) estimator, dynamic system GMM, panel grouped-mean FMOLS and panel quantile regression was used for the empirical results. From the different estimation techniques, we find that institutional quality moderates energy consumption and strengthens its effectiveness in abating carbon emissions. Renewable energy consumption is also found to reduce emissions significantly in the long run. Given the importance of institutional quality and renewable energy in reducing CO2 emission, the policymakers need to improve the quality of institutions and deploy more renewable energy for final consumption to achieve long-term climate goals.

Khan, Khan and Zuojun (2020) employed dynamic models OLS, fixed effect, random effect and generalized method of moments (GMM) estimators to examine the relationship between institutional quality and financial development in developing and emerging countries. Rule of law negatively affects financial development, which reveals that in most of the global countries, the rule of law is very feeble. Control of corruption index positively affected financial development in emerging and global panel which indicates that most of the countries have reduced corruption to low level. The study also found that emerging countries have reduced corruption, but other institutional indicators are found to be insignificant.

Methodology

Model Specification

From the above theoretical framework, the study presents the econometric model of international foreign direct investment in West Africa while this study will be incorporating the sustainable energy supply and institutional quality variables in foreign direct investment models.

Model 1: Model for Foreign Direct Investment

To address the objective two of the study which is to investigate the impact of sustainable energy supply and institutional quality on foreign direct investment in West African countries, the following model is specified:

FDI = *f*(ACE, EP, RLL, RQ, PS, GEF, VACC, COR)……(3.5)
Econometrically equation 3.3 is expressed as:

$$FDI_t = \beta_0 + \beta_1 ACE_{it} + \beta_2 EP_{it} + \beta_3 RLL_{it} + \beta_4 RQ_{it} + \beta_5 PS_{it} + \beta_6 GEF_{it} + \beta_7 VACC_{it} + \beta_8 COR_{it} + \varepsilon_{it} \quad \ldots\ldots(3.6)$$

Where:
FDI= Foreign Direct Investment
ACE= Access to Electricity
EP= Electricity Production
RLL= Rule of Law
RQ= Regulatory Quality
PS= Political Stability
GEF= Government Effectiveness
VACC= Voice and Accountability
COR= Control of Corruption

Model 2: Causality Test for Sustainable Energy Supply and Remittances

To address the objective three of the study which is to evaluate the direction of causality between sustainable energy supply and foreign direct investment in West African countries, the following granger causality model is specified:

$$FDI_{it} = \sum_{i=1}^{n} \alpha_{11i} SES_{t-i} + \sum_{j=1}^{n} \beta_{11i} FDI_{t-j} + \mu_{11t} - - - - - - (3.9)$$

$$SES_{it} = \sum_{i=1}^{n} \alpha_{21i} FDI_{t-i} + \sum_{j=1}^{n} \beta_{21i} SES_{t-j} + \mu_{21t} - - - - - - (3.10)$$

Equations 3.9 and 3.10 represent the main Granger causality models for this study. The study will distinguish three cases:

i. No Causality from SES to FDI if the estimated coefficient on the lagged SES in equation 3.9 is not significant statistically. (i.e$\sum_{i=1}^{n} \alpha_{11i} = 0$)
ii. Unidirectional causality exist from SES to FDI if the estimated coefficients on the lagged of GS in 3.9 is different from zero

statistically and significantly and the set of estimated coefficients on the lagged FDI in 3.10 is not statistically different from zero.

iii. Feedback, or bilateral causality is assumed; if when the set of SES and FDI coefficients are different from zero statistically significantly in both regressions

Model 3: Causality Test for Institutional Quality and Foreign Direct Investment

To determine the directional causality between institutional quality and remittances in West African countries, the following granger causality model is specified:

$$FDI_{it} = \sum_{i=1}^{n} \alpha_{11i}\, INSQ_{t-i} + \sum_{j=1}^{n} \beta_{11i} FDI_{t-j} + \mu_{11t} - - - - - - (3.11)$$

$$INSQ_{it} = \sum_{i=1}^{n} \alpha_{21i}\, FDI_{t-i} + \sum_{j=1}^{n} \beta_{21i} INSQ_{t-j} + \mu_{21t} - - - - - - (3.12)$$

Equations 3.11 and 3.12 represent the main Granger causality models for this study. The study will distinguish three cases:

i. No Causality from INSQ to FDI if the estimated coefficient on the lagged INSQ in equation 3.11 is not significant statistically. (i.e$\sum_{i=1}^{n} \alpha_{11i} = 0$)

ii. Unidirectional causality exist from INSQ to FDI if the estimated coefficients o the lagged of GS in 3.11 is different from zero statistically and significantly and the set of estimated coefficients on the lagged FDI in 3.12 is not statistically different from zero.

iii. Feedback, or bilateral causality is assumed; if when the set of INSQ and FDI coefficients are different from zero statistically significantly in both regressions.

Model Estimation Techniques

To achieve the objectives, the study employs dynamic panel Generalized Method of Moments (GMM) estimator, cross-sectional auto-regressive distributed regression (ARDL) and Dumitrescu and Hurlin Panel Causality Tests.

Data Source and Variable

The type of data that are used for this research work are mainly the secondary data, sourced from the World Development Indicator and International Monetary Fund of various issues on financial deepening and domestic investment covering the period of 2000 to 2021.

Research Design

This study adopted expost-facto method of research design and this is because investigation started after the fact has occurred without interference from the researcher and also for the fact that data needed for the study already exists.

Population and Sample Size for the Study

The population of the study is West African countries. However, the sample size is selected based on the following criteria: the region is the largest of the developing world where issues of stagnation of foreign direct investment are at the forefront of the current debate in economic development.

Countries that are ranked among Sub-Saharan African countries by UN will be included in this. In addition, the countries that are geographically part of Sub-Sahara Africa countries but are part of the Arab world were excluded in this study. The countries are chosen based on the records of their populations, market development and economic power. Based on the criteria, sixteen (16) countries in West African countries were chosen. The countries are Benin, Burkina Faso, Cape Verde, Côte D'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo. The beauty of the data from the World Bank is that all sub-Saharan African countries data are denominated in one single currency (U.S Dollars).

Data Presentation, Analysis and Interpretation of Results

Data Analysis for West African Countries

Table 4.1 Correlation Matrix

VARIABLE	ACE	EP	RULL	REGQ	POS	GOVTEFF	VACC	VIF
ACE	1.0000							1.32
EP	0.2473	1.0000						2.33
RULL	0.3162	-0.2631	1.0000					2.83
REGQ	0.4116	0.3268	0.2254	1.0000				1.52
POS	0.3012	-0.4273	0.4022	0.3621	1.0000			1.43
GOVTEFF	0.3622	-0.2436	0.2673	0.4176	0.2153	1.0000		1.26
VACC	0.4441	-0.3264	0.3658	0.2175	0.3725	0.3111	1.0000	2.74
Corrtn	0.2746	-0.3147	0.3442	0.3521	0.4023	0.2563	0.4124	2.61

Source: Author's Computation (2024).

Based on the findings of the correlation test, it can be noticed that there is no evidence of multicollinearity, since the coefficients of the selected variables are all below 0.5. Furthermore, the variance inflation factor was conducted and the results were less than 5 which shows the variables are not correlated. Therefore, the presence of multicollinearity cannot be observed among these variables.

Table 4.2 Result of Unit Root (Stationarity)Test

	IPS		LLC	
Statistics	At Level t-Statistics	At First Difference t-Statistics	At Level t-Statistics	At First Difference t-Statistics
FDI	3.2271(0.01263)	-9.2773(0.0000)	-4.5722(0.0511)	-8.5345(0.0000)
ACE	6.8451(1.0000)	-11.5722(0.0000)	-6.1162(0.0000)	-25.6241(0.0000)
EP	-1.517(0.8166)	-16.8419(0.0000)	21.1644(0.2111)	-30.1118(0.0000)
RULL	9.3573(0.0000)	-10.4473(0.0000)	11.5237(0.4165)	-10.6452(0.0000)
REGQ	7.9787(0.0000)	29.1185(0.0000)	6.4487(0.1011)	-6.5618(0.0000)
POS	-5.6095(0.000)	-14.3422(0.0000)	8.7243(0.0105)	-13.3164(0.0000)
GOVTEFF	4.8511(0.5373)	-7.8884(0.0000)	-2.6548(0.2518)	-16.9127(0.0000)
VACC	-14.3335(0.0000)	-18.9253(0.0000)	-19.5524(0.0000)	-23.6425(0.0000)
CORRTN	-1.7388(0.3748)	-12.6631(0.0000)	3.4725(0.3166)	-26.9156(0.0000)

Source: Author's Computation (2024) IPS and LLC refer to tests by Im, Pesaran & Shin (2003) and Levin, Lin & Chu (2002). In brackets, values above 5% are considered statistically significant. In the lack of a unit root, the null hypothesis is rejected (p-value 5%).

To properly assess the level of integration in a series, a unit root test must be performed. The unit root tests conducted in this study were based on the approaches described by Im, Pesaran, and Shin (2003) and Levin, Lin, and Chu (2002). The results of these tests are presented in Table 4.2. The results obtained from the IPS and LLC tests suggest that the variables of rule of law, regulatory quality, political stability, voice and accountability demonstrated stationarity at level. This implies that the aforementioned variables possess integration of order zero (I(0)), whilst the remaining variables demonstrate stationarity at first difference, signifying integration of order one (I(1)).

Table 4.3 Panel Regression Results for Foreign Direct Investment for West African Countries

	Dependent Variable: FDI WEST			
Independent Variables	Mean Group	Pooled Mean Group	Dynamic CCE (CS-ARDL)	GMM
FDI-L1				.6118393***
Long-run coefficients				(.0542774)
ACE	1.0293287*** (.0452659)	2.0311391*** (.0287105)	.210676*** (.0623285)	-.0347589** (.0122703)
EP	.3660542 (.3443859)	.702808*** (.2533197)	.0079505 (.4132429)	.0744474 (.1107759)
RULL	.7827927*** (.367354)	3.450255*** (.862423)	3.6921132*** (.740837)	-.326725 (1.934745)
REGQ	-.0400045 (3.180703)	6.513014 (3.038739)	1.613927 (3.307398)	-.8476105 (.6938354)
POS	.3634895 (1.166007)	-.036547 (.9471728)	.5047927 (1.298351)	.3595436 (.3963166)
GOVTEFF	-1.065493 (3.070638)	.2708486 (2.763025)	-.7429972 (3.29083)	.8334338 (1.425108)
VACC	-.3727064 (2.145485)	-.213202 (1.519812)	-1.614175 (2.669511)	.7099358 (.471132)
CORRTN	.076064*** (.0372105)	.0998966*** (.0358464)	.0771441** (.0302968)	.071943*** (.0177391)
Hausman Test	51.93(0.000)	21.40(0.0062)		
Wald chi2 statistic	264.06(0.000)	Autocorrelation test (Arellano-Bond test) AR(2)		
Sargan test statistic	268.74(0.3256)		0.94(0.349)	
Hansen Test	4.61(1.000)			
Short-run Coefficients				

Error correction	**-1.601421*** (.7443845)**	**2.579558** (1.250265)**	**1.6732864** (.817142)**	
ACE	.0142886*** (.0085582)	.071597*** (.0116819)	.0157491*** (.0017708)	
EP	-.0174355 (.0537939)	.1208161 (.0761612)	-.0754453 (.0657235)	
RULL	-.2630354 (.717323)	-1.3379 (1.328915)	.0932109 (.7729562)	
REGQ	.4329961 (.580498)	-2.902063 (1.021686)	-.512475 (.6396789)	
POS	.3089824 (.2797588)	1.136268 (.4862452)	.5343267 (.3161311)	
GOVTEFF	-.4161505 (.6155445)	1.837468 (1.137388)	-.2949526 (.6782146)	
VACC	.1176778 (.4246031)	1.534662 (.5901498)	-.3735745 (.5355793)	
CORRTN	.0155303** (.0073336)	.0239226** (.0150875)	.0065416 (.007985)	
CONS	.1424546 (3.060388)	.1258371 (5.033278)	.0290746 (3.236654)	

Source: Author's Computation (2024).
Standard errors in parentheses***, ** and * denotes 1%, 5% and 10% level of significance respectively

With the aid of Hausman test, the study choose the best suited model between the Pooled Mean Group and Mean Group as well as between the Pooled Mean Group and the Dynamic Fixed Effect. The test of this study, however, revealed that Mean Group is the best suitable model because the results were statistically significant. So, the Mean Group estimator serves as the foundation for our interpretation. The long-run assessment in Table 4.3 below indicates that, the access to electricity indicates a positive relationship with foreign direct investment and is significant at the 1% level. Essentially, every unit rise in access to electricity leads to a 1.0293287 increase in foreign direct investment. In addition, rule of law shows positive and significant effect on foreign direct investment. Therefore, every unit rise in rule of law leads to a .3173533 increase in foreign direct investment. Similarly, the control of corruption significant determinant to foreign direct investment at 1% level of significance with a coefficient value of .076064. This means a unit rise in control of corruption leads to .076064 increase in foreign direct investment.

Furthermore, as indicated in Table 4.3, the coefficient of the error correction term is -1.601421. Given the error term of .7443845, the value is statistically significant at 1%. Since it is negative and significant, it is implied that foreign direct investment responds to shocks from Access to Electricity (ACE), Electricity Production (EP), Rule of Law (RULL), Regulatory Quality (REGQ), Political Stability (POS), Government Effectiveness (GOVTEFF), Voice and Accountability (VACC) and Control for Corruption (CORRTN). This means that foreign direct investment is getting adjusted at a speed of -1.601421 from state of disequilibrium in the short run to the state of equilibrium in the long run.

However, for the two step GMM, in order to check the validity of the result, diagnostic tests were conducted and the results are presented in the lower part of Table 4.3. The Wald chi2 statistic 264.06with probability value 0.000 indicates that the model has a good fit. Moreover, the Sargan test statistic is 268.74with probability value 0.3256. The null hypothesis of the test that over identifying restrictions are valid cannot be rejected. This means, the instruments are valid. Further, the Arellano-Bond test for zero autocorrelation in first-differenced errors shows that the Z-statistic of the second order (AR 2) is 0.94with probability value 0.349. Hence, the null hypothesis of the test, no autocorrelation, cannot be rejected. Hence, there is no problem of autocorrelation in the model. The dependent variable for the GMM model is foreign direct investment while lag of foreign direct investment, Access to Electricity (ACE), Electricity Production (EP), Rule of Law (RULL), Regulatory Quality (REGQ), Political Stability (POS), Government Effectiveness (GOVTEFF), Voice and Accountability (VACC) and Control for Corruption (CORRTN) are the independent variables. The result indicated that lag of foreign direct investment, access to electricity and control of corruption are statistically significant at 1%level of significance. This is because half the values of the coefficients of the variable is greater than the standard errors of the coefficients. This means that lag of foreign direct investment, access to electricity and control of corruption have significant impact on foreign direct investment in West African countries.

Table 4.4 Dumitrescu-Hurlin Panel Causality for foreign direct investment in West Africa Countries

Null Hypothesis:	Obs	F-Statistic	Prob.
ACE does not Granger Cause FDI	320	0.95666	0.3853
FDI does not Granger Cause ACE		2.24616	0.1075
EP does not Granger Cause FDI	320	2.39943	0.0424
FDI does not Granger Cause EP		0.06205	0.9399
RULL does not Granger Cause FDI	320	1.19954	0.3027
FDI does not Granger Cause RULL		1.52675	0.2188
REG__Q does not Granger Cause FDI	320	1.70819	0.1829
FDI does not Granger Cause REG__Q		0.80593	0.4476
POS does not Granger Cause FDI	320	0.82248	0.4403
FDI does not Granger Cause POS		2.24440	0.1077
GOVT__EFF does not Granger Cause FDI	320	1.49841	0.2251
FDI does not Granger Cause GOVT__EFF		0.44375	0.6420
VACC does not Granger Cause FDI	320	1.00554	0.3670
FDI does not Granger Cause VACC		2.79580	0.0626
CORRTN does not Granger Cause FDI	320	1.83479	0.1613
FDI does not Granger Cause CORRTN		3.13306	0.0449

Source: Author's Computation (2024)

To investigate the direction of causality between sustainable energy supply, institutional quality and foreign financial inflows in Sub-Sahara African Countries. Dumitrescu and Hurlin (2012) Granger causality test was used and the result for West African countries considered in the study is presented

above. The result reveals that there is uni-directional causality between electricity production and foreign direct investment, and foreign direct investment and corruption. Hence, there is directional causality between institutional quality and foreign direct investment in West African countries.

Discussion of Findings

Fixed and random effects models and generalized method of moments (GMM) were employed to examine the impact of sustainable energy supply and institutional quality on foreign direct investment in West Africa. The dependent variable used is foreign direct investment while the independent variables are Access to Electricity (ACE), Electricity Production (EP), Rule of Law (RULL), Regulatory Quality (REGQ), Political Stability (POS), Government Effectiveness (GOVTEFF), Voice and Accountability (VACC) and Control for Corruption (CORRTN). The result of the study revealed that sustainable energy supply and institutional quality are significant determinant of foreign direct investment thereby showing a similar result with the works of Okoh and Ebi (2013); Dinkneh *et al.* (2019); Saidi, Montasser and Ajmi (2019); Saydaliyeva, *et al.* (2020); Khan, Khan and Zuojun (2020) and Khan, Khan and Zuojun (2020). The chi-square statistics for FDI in the hausman test findings provided that the fixed effect model supersedes empirical assumptions about the relationship and impact of the independent variables in the model. Therefore, the model passed all the diagnostic test and thus the result is plausible for policy suppositions on the impact of sustainable energy supply, institutional quality on foreign direct investment in West African Countries. Moreso, the findings from the result indicated that the variables are statistically significant at 1%, 5% and 10% level of significance. Therefore, generation of more electricity and its supply will lead to increase inflows of foreign direct investments in West Africa. Based on these, the null hypothesis that states that Sustainable energy supply and institutional qualities has no impact on foreign direct investment in West Africa should not be accepted. Moreso, the findings from the two step GMM to check the validity of the result shows that the Wald chi^2 statistics test conducted indicated that the model has a good fit while the sargan test statistics conducted indicated that the instruments used are valid. Also, the Arellano-Bond test conducted to check for autocorrelation in first difference error shows that there is no problem of autocorrelation in the model.

Conclusion and Recommendations

The study concluded that energy supply affects foreign direct investment in West Africa.

The study also concluded that there is a positive relationship between institutional qualities and foreign direct investment in West African countries. The study also concluded that there is bi-directional relationship between sustainable energy supply, institutional quality and foreign direct investment in West African countries. In line with the findings, it is recommended that government should improve on the level of investment in the energy sector as energy supply is seen as a major cause of having low attraction of foreign direct investment in the region. Also, government should strengthen the quality of their institutions such as the rule of law, political stability, control of corruption, government effectiveness, and voice and accountability, thereby reducing the risk of foreign investors and increase the level of foreign investors in West Africa. Political instability should also be discouraged as all elected government officials should be allowed to serve their tenure while military coup should not be allowed as political stability in the region will improve the participation and trust of foreign investors in augmenting domestic investment of host West Africa economies.

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