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# Moderating Effect of Institutional Quality on the Fdi-Energy Consumption Nexus in Selected African Countries

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**Abstract**

This study examines the moderating effect of institutional quality in FDI and energy consumption relationship in Africa spanning from 1996 to 2021. The analysis focuses on four of Africa's leading FDI recipient countries: Egypt, South Africa, Mozambique, and Ghana. The result of the Dynamic ARDL simulation techniques revealed that FDI increases energy consumption in Egypt, Mozambique, and Ghana in both the short and long run. In the case of South Africa, the result reported that FD1 reduces energy consumption in both the short run and long run. The inverted EKC U-shaped relationship between FDI and energy consumption was confirmed in Egypt, Mozambique, and Ghana, however, in the case of South Africa, the inverted EKC U-shaped was invalidated. The empirical evidence further indicates that the combined effect of FDI and institutional quality mitigates energy consumption for all sampled countries. This highlights the inherent limitations of FDI alone in realizing its full benefits and emphasizes the need for a strong institutional framework to fully leverage this capital. However, without vibrant institutions that are well-functioning, the positive effects of FDI on energy efficiency may be hampered. Hence, the presence of good institutions in a host country helps boost FDI absorptive capacity which has an important role in decreasing energy demand and promoting innovative adoption by increasing the substitutability between fossil fuels and energy-efficient technologies.

**Keywords:** Institutional Quality, Foreign Direct Investment (FDI), Energy Consumption, Dynamic ARDL Simulation, EKC Hypothesis

## Introduction

The 2015 Sustainable Development Goals (SDGs) prioritize shifting non-renewable to renewable energy consumption practices to improve the environment; However, oil and fossil fuel resources still account for more than 80% of total energy use in developing countries(International Energy Agency [IEA], 2019). It was further reported that worldwide carbon dioxide ($CO_2$) concentrations averaged 407.4 parts per million in 2018, $CO_2$ emissions from coal burning account for more than a third of the yearly average world surface temperatures over pre-industrial levels. The world's fuel consumption climbed by 237 percent from 1965 to 2019, with Africa seeing a 665 percent growth during the same period. According to the World Energy Council (WEC, 2019), fossil fuels are predicted to account for over two-thirds of worldwide primary energy in 2040

The Kyoto Protocol and the Paris Agreement are of one many concerted efforts by different nations towards combating the mounting threats of climate change worldwide and limiting greenhouse gas emissions (Yilanci et al., 2019). However, the adoption of renewable energy technologies (RETs) is more concentrated in industrialized economies, as their share of worldwide fossil energy consumption has decreased from 73.18 percent in 1970 to 40.34 percent in 2014. During the same period, developing countries' proportion of global fossil energy consumption climbed from 40.34 percent to 55.37 percent (World Bank, 2018). This demonstrates that the engagement to a green economy and the mitigation of ecological deterioration is still a long way off in the future, particularly in developing countries, where the demand for fossil energy remains unabated.

However, some studies,(e.g., Amoako & Insaidoo, 2021; Polat, 2018) on the other hand, have claimed that high upfront capital costs hamper the development of clean energy production processes in developing countries, information costs, and asset specificity. More crucially, Africa's potential to vault into a new era of growth will necessitate a shift to low-carbon, energy-efficient modern energy available to everyone. Thus, foreign capital inflows, such as FDI, are critical for African economies to support high-tech clean energy projects. This viewpoint is based on the potential for foreign capital inflows to have positive externalities in terms of foreign technology transfer and knowledge spillover effects. Thus, the desire of developing countries to run energy-saving technologies could be traced to one of the reasons for the adoption of friendly policies towards FDI (Olaoye et al., 2020).

Evidence from empirical studies on the relationship between FDI and energy consumption shows that literature is scarce on this topic. The few available ones (e.g., Amoako & Insaidoo, 2021; Polat, 2018) primarily focused on the direct impact of FDI and energy consumption without considering the conditional impact of FDI and energy consumption. This is comparable to ignoring the crucial role of the institution in shaping economic fundamentals dynamics. The EKC theory, on the other hand, is government-induced as opposed to the income (market-induced) approach that predominates in the existing body of research (Alhassan et al., 2020; Sarkodie, 2018). Moreover, institutions have a significant impact on the efficiency of trade flows (Kilishi, 2017). Even though few studies (e.g., Muhammad et al., 2021; Sarkodie et al., 2020) have investigated the influence of institutions in the FDI-energy consumption relationship, the majority of these studies use restrictive measures of institutional quality, which they concede in their study's limitations. Using such limited measures as a proxy for institutional quality could lead to erroneous conclusions. Because institutional quality plays a crucial part in maximizing the economic benefits derived from FDI, the purpose of this research is to fill a gap by adopting a composite governance index as a proxy for institutional quality to evaluate the moderating effect that it plays in the relationship between FDI and energy consumption. Through the provision of theoretical and empirical insights into the nature of the relationship between institutional quality and energy use, the analysis contributes to the existing body of economic research. Furthermore, it will shed light on how differences in institutional frameworks are the driving force behind the variability in the impacts of FDI on energy consumption, notably in the economies of Africa that are the top recipients of FDI.

Moreover, building on the fact that most previous studies have primarily examined the linear relationship between FDI and energy consumption, this study advances the literature by investigating the nonlinear effects of FDI on energy consumption. Specifically, it incorporates the squared terms of both FDI and GDP per capita (a proxy for economic growth) to test the validity of the U-shaped Environmental Kuznets Curve (EKC) hypothesis. By doing so, the analysis provides a more comprehensive understanding of the FDI-energy consumption relationship and offers empirical validation of the EKC hypothesis in the context of selected African countries.

The research is then structured as follows: Section 2 presents a literature review pertinent to the study's scope, while Section 3 describes the data and methodology. The empirical results are discussed in Section 4, while the conclusion and policy implications are presented in Section 5.

**Literature Review**

Different authors have made scholarly contributions and findings in their quest to ascertain the relationship between FDI and energy consumption. Some have come up with positive feedback, while others have come up with negative feedback using different econometric techniques and the scope of study. Thus, this section covers an in-depth review of some of these studies to gain a robust understanding as well as insight into the subject matter.

Zeeshan et al (2021), in their empirical investigation on the nexus between FDI and energy consumption, found using a Structural Equation Modeling technique to establish that FDI enhanced energy consumption in Latin countries between the period 1990 to 2018. This was similar to the findings by Muhammad et al (2021), who employed Pedroni, Westerlund, and Kao test from 2002 to 2014 to confirm a long-run and positive relationship between FDI and energy consumption in selected 13 Muslim nations. In the same vein, Sarkodie et al (2020), confirmed that FDI exacerbated energy consumption in some selected 47 Sub-Saharan nations between the periods 1990 to 2017. However, in the case of ASEAN countries, Kumaran et al (2020), investigation based on the result from the FMOLS and DOLS regression analysis revealed that FDI promotes renewal energy consumption in the region within the period under study from 1990 to 2016.

Olaoye et al (2020), empirically investigate how FDI influences energy consumption in Nigeria. Findings from the result revealed that increasing FDI did not exacerbate energy consumption in Nigeria within the study period from 1990 to 2017. Similarly, it was found by Cao et al (2020), employed the panel regression and panel smooth transition regression (PSTR) and panel data from 1990 to 2014 to confirm that FDI is not a key factor in the increasing energy intensity in BRICS and non-BRICS countries within the study period. This claim was refuted by (Ayinde et al., 2019), who employed the VEC model and time-series data from 1980 to 2016 to argue that FDI increases energy consumption. In contrast, Kim (2019), claimed that FDI

exacerbates energy consumption, having employed the panel vector error correction model (VECM) to establish this claim in selected 57 developing nations.
Gil et al (2019), advocated for an appropriate policy to reduce energy consumption, having confirmed using the ARDL model that the increasing energy consumption in Pakistan could be linked to FDI inflow. However, Yilanci et al (2019), empirical investigation on the relationship between FDI and renewable energy consumption in Brazil, Russia, India, China, and South Africa from 1985 to 2017 confirmed that FDI promoted clean energy consumption only in Russia. Uzar and Eyuboglu (2019), on the other hand, employed the Fourier ADL and ARDL tests and time-series data from 1980 to 2015 to confirm that FDI enhances energy consumption in Turkey. Similarly, this was in line with Kiliçarslan (2019), who employed the panel data approaches to establish the significant role of FDI inflow in the increasing energy consumption in BRICS countries and Turkey.

Polat (2018), used a dynamic panel data technique to examine how FDI influences renewable and non-renewable energy consumption in 85 industrialized and developing countries from 2002 to 2014. The study found that FDI lowers energy usage in industrialized countries while having little effect in developing countries. In the same vein, Shahbaz et al (2018), found that FDI enhances renewable energy consumption in the Next-11 countries while it has no significant impact in the BRICS regions. On the other hand, Huang (2018) employed a panel smooth transition regression model to empirically investigate the effect of FDI on energy consumption in 30 Chinese provinces. Findings from the regression report revealed that FDI has a significant non-linear effect on energy consumption in the region between the periods under study from 1995 to 2015. Similarly, in the case of emerging economies, Tsaurai (2018) reported that FDI is a key determinant of increasing energy consumption in the region, having employed the fixed and random effect econometric method for the regression analysis.

Mavikela & Khobai (2018) examine the effect of FDI on energy consumption in Argentina using the Autoregressive Distributed Lag (ARDL) bounds testing approach. Their finding reported that within the period 1970 to 2016, FDI positively affected energy consumption. The implication of this is that the increasing energy consumption in the country could be linked to the increasing FDI inflow in the country. Similarly, according to the panel study by Lin and Benjamin (2018), it was found that from the period 1990 to 2014, FDI was a significant contributor to increasing energy consumption in Nigeria, Turkey, Mexico, Pakistan, and Turkey. However, this claim was refuted by Petrović et al. (2018) argued in their study that FDI inflow reduces energy intensity Union by promoting renewable energy consumption in European countries within the period under study from 1990 to 2014

A dynamic panel model from 2001 to 2013 was employed by Wang (2017) to explore the nexus between FDI and energy efficiency in China. It was reported that, on a national basis, the trend of total-factor energy efficiency (TFEE) was higher across the sample period, while the growth rate was downward. The TFEE in the eastern region was higher than in the central and western regions on a regional basis. Furthermore, FDI considerably increased energy efficiency, demonstrating that the ‘‘pollution halo" effect outweighed the ‘‘pollution haven" effect. Technical progress was cited as the primary cause of the increase in TFEE, whereas technical efficiency was cited as the primary cause of the decrease. In the same vein, this was also confirmed by Salim et al (2017), who found that FDI enhances energy-efficient technology by reducing energy intensity in China.

Kutan et al (2018), employed the fully modified ordinary least squares methodologies between the period 1990 to 2012 to confirm that FDI increases energy consumption in Brazil, China, India, and South Africa. Similarly, Adom and Amuakwa-Mensah (2016) confirmed that FDI reduces energy consumption in some selected African economies. In Contrast, Doytch and Narayan (2016) employed the Blundell-Bond dynamic panel estimator to establish the positive relationship between FDI and non-renewable energy consumption in high- and upper-middle-income nations from the period 1985 to 2012

**Model and Data**

*Model Specification*

This study uses a linear econometric framework to investigate the extent to which FDI has an impact on energy consumption in African countries, based on the existing works of Azam et al. (2015) and Murshed et al. (2022). Consistent with them, energy consumption is taken as the dependent variable and it is detailed in the form of a function of FDI inflows controlling for other macroeconomic, structural, and policy indicators that could determine how strong or weak the relationship between FDI influxes to the economy would be on its concordant effect over the total amount spent by an economy. Through providing this framework, the model opens up a field to explore direct and indirect pathways of FDI effect on energy consumption that also has capabilities controlling for issues related to endogeneity, and omitted variable bias among other econometric challenges. The specification of the baseline model is:

$$lnEC_t = \beta_0 + \beta_1 lnGDPpc_t + \beta_2 lnFDI_t + \beta_3 lnGOV_t + \beta_4 lnFD_t + \beta_5 lnHC_t + + \varepsilon_t \qquad (1)$$

Where is EC, the dependent variable in the equation is energy consumption and it is measured as a percentage of total fossil fuel energy consumption, GDPpc is GDP per capita (constant 2010 US$) which is a proxy for economic growth, FDI which is the principal regressors of interest measured as FDI inflow as a percentage of host country GDP, GOV is good governance index (a proxy for institutional quality), FD is financial development, measured as the ratio of private sector credit to GDP, and HC is human capital development measured as a percentage of gross primary school enrolment. Additionally, t represents the time, while $\varepsilon$ denotes the error term. $\beta_0$ is the intercept (or constant), $\beta_1$- $\beta_5$ are the coefficients of the independent variables. All variables have been transformed into their natural logarithms to facilitate the estimation of conditional bivariate elasticities."

In line with the energy-environmental Kuznets curve as applied byWang and Jiayu (2019) and Aruga (2019), equation 1 is expanded by incorporating the square term of GDP and FDI. The energy-environmental Kuznets curve shows that energy consumption rises in tandem with economic growth at first but then drops as energy-efficient technology is employed to increase domestic production at a certain threshold level of growth in the economy(Shahbaz et al., 2018) The modified energy-environmental Kuznets equation is presented as thus:

$$lnEC_t = \gamma_0 + \gamma_1 lnGDPPC_t + \gamma_2 GDPPC_t^2 + \gamma_3 ln\, FDI_t + \gamma_4 ln\, FDI_t^2 + \gamma_5 lnGOV_t + \gamma_6 lnFD_t + \gamma_7 lnHC_t + \varepsilon_t \qquad (2)$$

Where $\gamma_1 > 0$ and $\gamma_2 < 0$ shows the environmental Kuznets curve phenomenon between economic growth and energy consumption; and $\gamma_3 > 0$ and $\gamma_4 < 0$ shows the environmental Kuznets curve phenomenon between FDI and energy consumption.
Equation (2) is further modified to incorporate the interaction between FDI and the institution's quality. Thus the equation becomes:

$$lnEC_t = \chi_0 + \chi_1 lnGDPpc_t + \chi_2 GDPpc_t^2 + \chi_3 lnFDI_t + \chi_4 lnFDI_t^2 + +\chi_5 lnGOV_t + \chi_6(lnFDI * GOV)_t + \chi_7 lnFD_t + \chi_8 lnHC_t + \varepsilon_t \quad (3)$$

The interaction term is used in this specification to determine the conditional effect of FDI on energy consumption. In other words, it demonstrates that there would be a conditional hypothesis that an increase in FDI would increase energy consumption subject to the institutional quality of the host country. According to Hunjra et al. (2020) and Naz et al.(2019), the conditional hypothesis is well described by the multiplicative interaction model. If the FDI*GOV coefficient is proven to be significant and positive. This would imply that the influence of FDI on energy consumption is dependent on the host country's quality of the institution.

To mitigate potential multicollinearity between the interaction term and the main variables, the interaction term ($\chi_8$) is renormalized following the procedure outlined by Balli and Sørensen (2013). This normalization technique ensures that the interaction term is orthogonal to the main effects, thereby reducing multicollinearity and improving the interpretability and reliability of the estimated coefficients in the model.

$$lnEC_{it} = \chi_0 + \chi_1 lnGDPpc_t + \chi_2 GDPpc_{it}^2 + \chi_3 lnFDI_t + \chi_4 lnFDI_{it}^2 + \chi_5 lnFDI_{it}^3 + \chi_6 lnGOV_{it} + \chi_7(FDI - \overline{FDI})(GOV - \overline{GOV})_t + \chi_8 lnFD_t + \chi_9 lnHC_t + \varepsilon_t \quad (4)$$

**Data Source**
This study makes use of time-series data from four countries that are among the leading recipients of FDI in Africa spanning from 1996 to 2021. The Countries are Egypt, South Africa, Mozambique, and Ghana. Data for all variables were obtained from the World Bank's World Development Indicators (WDI). The dependent variable used in this study is energy consumption, measured by the percentage of total fossil fuel consumption. The independent variable is; foreign direct investment, GDP per capita, institutional quality (good governance), financial development, and human capital development,

Table 1
*Summary of Variables and Measurement*

| Variables | Symbols | Measurement |
|---|---|---|
| **Dependent Variables** | | |
| Energy Consumption | EC | Fossil fuel energy consumption (% of total) |
| **Independent Variables** | | |
| Foreign Direct Investment | FDI | FDI inflow as a percentage of host country GDP |
| GDP per capital | GDPpc | GDP per capita (constant 2010 US$) |
| Good Governance | GOV | Percentiles of Countries |
| Financial Development | FD | The ratio of private sector credit to GDP |
| Human Capital Development | HC | School enrollment, primary (% gross) |

**Estimation Method: Dynamic ARDL (DyARDL) Simulations Model**

This study will make use of the novel dynamic ARDL (dynardl) simulations model developed by Jordan and Philips (2018). This is because testing long-run and short-run equilibrium relationships, in both levels and differences may be accomplished using this method Also included in the Dynamic ARDL (dynardl) simulations is a graphical interface that enables researchers to evaluate the feasibility of a hypothetical variation in the desired parameter based on the principle of ceteris paribus (other things being equal).

**Unit Root Test**

Before engaging and the dynamic ARDL simulations, it is necessary to run a unit root test on each series to identify the stationary status of the series and their respective order of integration. This is because if any of the variables are non-stationary, it may result in spurious regression results (Abbasi & Adedoyin, 2021). Although the dynardl approach can be executed regardless of the action of variables that is, 1(0), 1(1), or a combination of both, however, to ensure that none of the variables are second differenced, that is, 1(2), the study employs the unit roots tests by Dickey and Fuller (1979), Phillips and Perron (1988), and (Kwiatkowski et al., 1992).

**Cointegration Test**

Following an examination of the fundamental statistical properties of the data series, a combination of techniques will be utilized to determine the degree to which the variables are cointegrated. To be more specific, we will use the ARDL bounds testing approach by Pesaran et al. (2001). This will be supplemented by the cointegration technique proposed by Bayer and Hanck (2013) With the help of this all-encompassing technique, we will be able to arrive at a reliable result concerning the cointegration relationship between FDI and energy consumption in the selected African nations.

**ARDL Bound Testing Approach**

This study will use the ARDL (Autoregressive Distributed Lag) bound testing technique that was presented by Pesaran et al (2001), to explore the long-term relationship between FDI and energy consumption in the selected African nations. The use of this approach makes it possible to conduct an accurate study of the relationships between these variables, taking into consideration both the possibility of long-term and short-term dynamics of the relationship. We hope that by employing this reliable technique, we will be better able to comprehend the dynamic relationship that exists between FDI and energy consumption in the African context. In contrast to previous cointegration approaches such as Engle and Granger (1987) Johansen (1988), and Johansen et al. (1990), the ARDL cointegration approach offers significant advantages: First, the ARDL technique is applicable regardless of whether the regressors are I(1) and/or I. (0). This means that the ARDL technique avoids classifying variables as I(1) or I(0) and eliminates the necessity for unit root pre-testing. The second point is that, although the validity of the Johansen cointegration procedures is dependent on large data samples, the statistical significance of the ARDL process is higher when determining the cointegration relationship in small samples. Third, the ARDL approach creates the possibility that the variables have various optimum lags, whereas this is not conceivable with standard cointegration processes. More also, the ARDL approach makes use of a single reduced-form equation, whereas traditional cointegration strategies estimate long-run relationships within the framework of several system equations (Sufyanullah et al., 2022) The ARDL bound test can be represented as thus:

$$lnEC_{it} = \emptyset_0 + \emptyset_1 lnEC_{t-1} + \emptyset_2 lnGDPpc_{t-1} + \emptyset_3 GDPpc_{t-1}^2 + +\emptyset_4 lnFDI_{t-1} + \emptyset_5 lnFDI_{t-1}^2 + \emptyset_6 lnGOV_{t-1} + \emptyset_7 (lnFDI * GOV)_{t-1} + \emptyset_8 lnFD_{t-1} + \emptyset_9 lnHC_{t-1} + \sum_{i=1}^{p} \gamma_1 \Delta lnEC_{t-1} + \sum_{i=1}^{q} \gamma_2 \Delta lnGDPpc_{t-1} + \sum_{t=1}^{q} \gamma_3 \Delta GDPpc_{t-1}^2 + + \sum_{i=1}^{q} \gamma_4 \Delta lnFDI_{t-1} + \sum_{i=1}^{q} \gamma_5 \Delta lnFDI_{t-1}^2 + \sum_{i=1}^{q} \gamma_6 \Delta lnGOV_{t-1} + \sum_{i=1}^{q} \gamma_7 \Delta \ln (FDI * GOV)_{t-1} + \sum_{i=1}^{q} \gamma_8 \Delta lnFD_{t-1} + \sum_{i=1}^{q} \gamma_9 lnHC_{t-1} \ \mu_t + \varepsilon_{it} \quad (5)$$

where $t$ denotes the lag length, $t-i$ is the "optimal lags derived applying the Akaike information criteria (AIC), $u_t$ signifies the error term, Δ is the first difference operator, and the long-term association is examined by the ∅ . It is important to conduct a hypothesis test to establish a long-run relationship between the variables under investigation in the bound testing technique. The null and alternative hypotheses are stated as ($H_0$: $\emptyset_1 = \emptyset_2 \ldots = \emptyset_5 \ldots. = \emptyset_9 = 0$), and ($H_0$: $\emptyset_1 \neq \emptyset_2 \ldots \neq \emptyset_5 \ldots. \neq \emptyset_9 \neq 0$), respectively. As part of this procedure, the obtained F statistics are compared to the critical values at the lower and higher bounds. It is not possible to reject the null hypothesis when the estimated F statistics are smaller than the upper bound value of the confidence interval. When the estimated F statistics is greater than the upper bound critical value, the null hypothesis is rejected, indicating that the variables have a long-term relationship" (Agboola et al., 2022; Zhang et al., 2023).

**Bayer and Hanck Cointegration Approach**

The cointegration test by Bayer and Hanck (2013) and the ARDL bound testing technique by Pesaran et al. (2001) are put to use in this study to guarantee the reliability of the cointegration status of the variables. The Bayer and Hanck (2013) cointegration test presents more extensive findings since it makes use of several individual test statistics based on tests conducted by Engle and Granger (1987), Johansen (1991), Boswijk (1995), and Banerjee et al. (1998). Following what is described in (Bayer and Hanck (2013), the p-values derived from these numerous cointegration tests are aggregated using Fisher's methods as thus:

$$EG - JOH = -1[\ln(P_{EG}) + [\ln(P_{JOH})$$

$$EG - JOH - BO - BDM = -2[\ln(P_{EG}) + [\ln(P_{JOH}) + \ln(P_{BO})\ln(P_{BDM})$$

The $P_{EG}$ ,$P_{JOH}$, $P_{BO}$ and $P_{BDM}$ are the p-values of Engle-Granger (EG), Johansen (JOH), Boswijk (BO), and Baneerjee-Dolado-Mestre (BDM) cointegration tests, respectively. In a circumstance in which the computed Fisher's statistic is higher than the critical value, the null hypothesis of no cointegration will be rejected.

**Dynamic Autoregressive Distributed Lag Simulations**

Model specifications for ARDL models may be quite complex with lags, contemporaneous values, first differences, and lagged first differences of the independent (and occasionally dependent) variable all featured in the research model for the dependent variable (Islam et al., 2022). To resolve these complexities and problems, Jordan and Philips (2018), provided new dynamic simulations of the ARDL model to capture the impact of regressor changes on the independent variable utilizing simulations. By applying stochastic simulation techniques, the dynamic simulations ARDL methodology can display the impact of a counterfactual variation in one regressor at a specified moment while keeping all other variables constant. Using the OLS methodology, this strategy first estimates a regression model, after which it runs the model utilizing a user-specified number of simulations (usually 1000 simulations are taken into consideration), using a vector of parameters drawn from a multivariate normal distribution.

These distributions are considered to have the same mean and variance as the predicted values obtained by the OLS regression approach and the VAR-COV matrix, respectively. New Dynamic ARDL simulates $\sigma^{2}*$ by taking draws from the scaled inverse $\chi^2$ distribution, which allows the model to include stochastic uncertainty in the creation of anticipated values. Scaling the distribution by the residual degrees of freedom (n - k) as well as the predicted $\sigma^2$ from the regression guarantees that draws of $\sigma^{2}*$ is between zero and one Das et al. (2022). Once the simulated parameters and sigma-squared values have been calculated, they are utilized to forecast the dependent variable across time, $Y_t$, for each of the simulations. This is accomplished by setting all covariates to specific values (typically means).

The introduction of stochastic uncertainty into the forecast is accomplished by drawing a random number from a multivariate normal distribution with mean zero and variance $\sigma^{2}*$. Subsequently, using averages across all simulations, researchers can calculate *Yr** (the expected values plus stochastic uncertainty) and percentile confidence intervals for the distribution of simulated values at every given moment in time. There will also be impulse response diagrams included in the simulations, which will allow researchers to see graphically how the independent variable's situation has altered as a result of changes in the regressors' values".” The model presented by Jordan and Philips (2018) will serve as the foundation for the new dynamic ARDL simulations

$$\Delta lnEC_{it} = \emptyset_0 + \emptyset_1 \Delta lnEC_{t-1} + \emptyset_2 \Delta lnGDPpc_{t-1} + \emptyset_3 \Delta GDPpc^2_{t-1} + \emptyset_4 \Delta lnFDI_{t-1} + \emptyset_5 \Delta lnFDI^2_{t-1} + \emptyset_6 \Delta lnGOV_{t-1} + \emptyset_7 \Delta(lnFDI * GOV)_{t-1} + \emptyset_8 lnFD_{t-1} + \emptyset_9 \Delta lnHC_{t-1} + \gamma_1 lnEC_{t-1} + \gamma_2 lnGDPpc_{t-1} + \gamma_3 GDPpc^2_{t-1} + \gamma_4 lnFDI_{t-1} + \gamma_5 lnFDI^2_{t-1} + \gamma_6 lnGOV_{t-1} + \gamma_7 ln(FDI * GOV)_{t-1} + \gamma_8 lnFD_{t-1} + \gamma_9 \Delta lnHC_{t-1} + \varepsilon_{it} \quad (6)$$

Where $\emptyset_0$ is the intercept, the $\emptyset_i s$ are the short-run coefficients while the $\gamma_i s$ are the long-run coefficients of the ARDL model

**Result Interpretation**

*Test for Stationarity*

The ADF and PP unit root tests, as well as the confirmatory non-unit root test of KPSS, were utilized in this study to analyze the stationarity features of the variables that were under investigation. The results of these analyses are detailed in Table 2. According to the empirical data, not a single one of the series displayed stationarity at the 1(2) level across the board for the selected countries. However, the null hypothesis of non-stationary cannot be rejected at level for ADF and PP unit root test, but it is rejected at the first difference where the t-statistic is less than the critical value of -3.00 at a 5% significance level. Furthermore, the null hypothesis of stationarity in the case of KPSS test cannot be rejected absolutely for all variables at level, however, all the variables attained a stationarity status at first difference where the critical value is greater than the t-statistics. This confirms that all the variables are stationary at the first difference. Consequently, all data series are integrated into order one, that is, 1(1) and prospective applications for the dynamic ARDL bounds testing approach

Table 2
*Unit Root Test*

| **Country** | | **ADF test** | | **PP test** | | **KPSS** | |
|---|---|---|---|---|---|---|---|
| **Egypt** | **Variable** | **Level** | **Diff.** | **Level** | **Diff.** | **Level** | **Diff.** |
| | | *-3.00* | *-3.00* | *-3.00* | *-3.00* | *0.15* | *0.15* |
| | EC | -1.30 | -6.51 | -1.23 | -6.45 | 0.18 | 0.05 |
| | FDI | -1.72 | -3.75 | -2.11 | -3.96 | 0.23 | 0.09 |
| | GDPPC | -0.41 | -3.38 | -0.45 | -3.45 | 0.20 | 0.12 |
| | GOV | -1.34 | -4.02 | -1.18 | -4.02 | 0.15 | 0.11 |
| | FD | -0.45 | -3.34 | -0.75 | -3.27 | 0.17 | 0.12 |
| | HC | -0.20 | -6.04 | 0.20 | -6.38 | 0.27 | 0.08 |
| **South Africa** | EC | -1.16 | -5.88 | -1.05 | -5.93 | 0.21 | 0.05 |
| | FDI | -5.29 | -7.74 | -5.34 | -8.91 | 0.04 | 0.02 |
| | GDPPC | -1.24 | -4.85 | -1.16 | -4.95 | 0.49 | 0.06 |
| | GOV | 0.65 | -4.50 | 1.41 | -4.30 | 0.22 | 0.06 |
| | FD | -2.43 | -5.02 | -2.44 | -5.03 | 0.32 | 0.04 |
| | HC | -1.44 | -5.82 | -1.67 | -5.74 | 0.29 | 0.04 |
| **Mozambique** | EC | -0.01 | -5.18 | 0.23 | -5.22 | 0.49 | 0.06 |
| | FDI | -1.35 | -3.53 | -1.54 | -3.54 | 0.25 | 0.13 |
| | GDPPC | -2.53 | -3.46 | -2.04 | -3.38 | 0.34 | 0.10 |
| | GOV | 0.18 | -3.72 | -0.13 | -3.72 | 0.51 | 0.11 |
| | FD | -0.98 | -3.72 | -1.14 | -3.08 | 0.26 | 0.12 |
| | HC | -3.98 | -3.37 | -3.31 | -4.27 | 0.59 | 0.11 |
| **Ghana** | EC | -2.37 | -5.09 | -3.34 | -5.13 | 0.54 | 0.02 |
| | FDI | -1.42 | -3.80 | -1.53 | -3.77 | 0.29 | 0.08 |
| | GDPPC | 1.51 | -3.60 | 1.42 | -3.61 | 0.46 | 0.08 |
| | GOV | -2.42 | -5.83 | -2.44 | -5.99 | 0.45 | 0.02 |
| | FD | -3.27 | -5.85 | -3.32 | -5.97 | 0.40 | 0.03 |
| | HC | -1.18 | -5.09 | -1.18 | -5.10 | 0.36 | 0.13 |

**N**otes: The critical value for ADF Test and PP Test is -3.00. The critical value for KPPS is 0.146.

**Lag Selection Criteria**
Table 3 displays the results of various test criteria for the selection of lags. AIC, SIC, and HQ are famous for choosing appropriate lags. According to the result, lag one is appropriate for all the countries given that most of the criteria selected lag one as the optimal lag. Moreover, the AIC is adopted in this study being the least value among the selected criteria at lag one.

Table 3
*Lag Selection Criteria*

| Country | Lag | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| **Egypt** | 0 | - | 0.46 | 2.33 | 2.35* | 2.13 |
| | 1 | 1.84 | 2.45* | 1.85* | 2.37 | 2.12* |
| | 2 | 0.11 | 0.49 | 2.02 | 2.50 | 2.21 |
| **South Africa** | 0 | -27.18 | - | 0.55 | 2.76 | 3.06 |
| | 1 | -21.34 | 8.28* | 0.53* | 2.36* | 2.7* |
| | 2 | -21.33 | 0.01 | 0.58 | 2.44 | 2.84 |
| **Mozambique** | 0 | -20.74 | - | 5.03 | 2.23 | 2.52 |
| | 1 | -19.27 | 2.09 | -4.04* | 2.19* | 2.53* |
| | 2 | -19.24 | 0.04 | 4.07 | 2.27 | 2.66 |
| **Ghana** | 0 | - | 9.08 | 3.83 | 5.33 | 5.11 |
| | 1 | 17.71* | 3.50 | 3.48* | 4.42* | 4.17 |
| | 2 | 1.83 | 3.47* | 3.54 | 4.44 | 4.14* |

LR, sequential modified LR test statistic; FPE, final prediction error; AIC, Akaike information criterion; SIC, Schwarz information criterion; HQ, Hannan-Quinn information criterion. * Symbolizes lag order selected by the criterion.

**Cointegration Test**

The research examined whether or not there was evidence of an established relationship among the series by employing the ARDL bounds testing approach by Pesaran et al (2001), in tandem with the innovative techniques developed by Bayer and Hanck (2013) The results of both tests are presented in Table 4. According to the ARDL bound tests result, a long-run relationship was confirmed among the series for the selected countries namely, Egypt, South Africa, Mozambique, and Ghana. This inference is confirmed by the estimated F-statistics exceeding the upper limit value at a 5% level of significance. Moreover, a confirmatory test was conducted using the Bayer-Hanck test to affirm the long-run relationship status of the variables. The result of the Bayer-Hanck test revealed that the values of both the EG-j statistics and EG-J-Ba-Bo are greater than their respective critical value at a 5% significance level in the selected countries. This further confirms that a long-run relationship exists among the series for all the selected countries.

Table 4
*Cointegration Test*

| | **ARDL Bound Test** | | **Bayer-Hanck** | |
|---|---|---|---|---|
| **Country** | **F-Stat.** | **K** | **Fisher type** | |
| | | | **EG-J** | **EG-J-Ba-Bo** |
| Egypt | 4.999 | 4 | 57.2408 | 112.503 |
| South Africa | 4.639 | 4 | 56.0693 | 74.5883 |
| Mozambique | 5.096 | 4 | 20.0970 | 27.7963 |
| Ghana | 10.567 | 4 | 57.8971 | 114.131 |
| Pesaran et al. (2001) Critical Value Bounds | | | 5% critical value | |
| Significance | I(0) Bounds | I(1) Bounds | EG-J | 10.419 |
| 5% | 2.62 | 3.79 | EG-J-BaBo | 19.888 |

**Results and Discussion of Findings**

The findings that were obtained by running the dynamic ARDL model are presented in Table 5.

In the case of Egypt, the findings revealed that the linear and direct impact of FDI on energy consumption is positive both in the long run and short run. More specifically, a 1% increase in FDI inflow will lead to about 0.32% and 0.29 increase both in the short run and long run, respectively. This result supports the claim of the pollution haven hypothesis and is consistent with Kutan et al (2018), who also found that FDI increases energy consumption in Brazil, China, India, and South Africa. However, the coefficient of the squared FDI is negative in both the short run and long run which confirms a U-shaped relationship between FDI and energy consumption. This suggests that energy consumption in Egypt increases throughout the early stages of FDI expansion but begins to fall once the optimal level of FDI is achieved. This result is in favour of the u-shaped EKC hypothesis. Similarly, the long-run coefficient of linear GDPPC is positive and significant with a value of 0.0190 while the long-run coefficient of squared GDPPC is negative and significant with a value of -0.0368. This also implies that energy consumption in Egypt increases during the early stages of economic development but begins to fall once the country has reached a certain level of development. In line with the theoretical prediction, good governance has a significant and negative impact on energy consumption in both the short run and long run. Meaning that a percentage increase in good governance will reduce energy consumption by approximately 0.02% and 0.08% in the short-run and long-run, respectively. The result further revealed that financial development has a significant positive effect on energy consumption in the long run with a coefficient value of 0.0499, meaning that a percentage increase in financial development will increase energy consumption by 0.049%. This can be further interpreted as the firms that benefitted from the financial system of Egypt still have still tendency to use more fossil energy sources in the production process. This empirical result is consistent with the findings of Ayinde et al. (2019). Similarly, the long-run coefficient of human capital development is positive and significant which implies that human capital development is a major contributor to increased energy consumption in Egypt. The result is in line with (Muhammad et al (2021), who found that human capital development increases energy consumption. The speed of adjustment is measured using the error correction term (ECT). The value of ECT is negative and statistically significant at the 5% level of significance. The ECT indicates that the rate of change in the previous equilibrium is around 1.21% in a year.

In the case of South Africa, both the short-run and long-run coefficients on FDI are negative with their respective values of -0.573 and -0.647. This implies that a percentage increase in FDI will reduce energy consumption by 0.57% and 0.64% in the short-run and long-run, respectively. This suggests that FDI helps to reduce fossil fuel consumption in South Africa by promoting energy-saving technology. The result is consistent with Salim et al (2017), However, the squared FDI is found to be positive, which rules out the existence of the inverted u-shaped relationship between FDI and energy consumption. The result further revealed that GDP per capita increases energy consumption both in the short-run and long-run. Moreover, the negative coefficients on GDPPC squared provide support to the inverted U-shaped relationship between economic development and energy consumption. This finding is in line with Nguyen (2018) Furthermore, it was revealed that good governance has a negative impact on energy consumption, while the impact of financial development and

human capital development are positive in both the short run and long run. The result of ECT shows a negative coefficient suggesting that the rate of adjustment is 0.61% per year.
In the case of Mozambique, the impact of FDI on energy consumption is found to be positive both in the short run and long run. The results imply that a percentage increase in FDI will lead to about 0.33% and 0.422% in energy consumption in the short and long run, respectively. Moreover, the significant negative coefficient of the squared GDP validates the inverted u-shaped relationship between FDI and energy consumption in the short and long run. However, in the case of GDPPC, the inverted u-shaped relationship is not supported since the coefficients of GDPPC are both negative in the short-run and long run, while the coefficients of the squared GPPPC are both positive in the short-run and long-run, respectively. Good governance has a significant negative impact on energy consumption in the short run and long run, financial development has a positive but not significant impact on energy consumption, while human capital development has a positive and significant impact on energy consumption in the long run and short run respectively. Finally, the ECT suggests that the rate of adjustment is 1.30% per year.

In the case of Ghana, the inverted-shaped relationship between FDI and energy consumption only exists in the short run given that the linear FDI is positive (0.599) and squared FDI is negative (0.0855). On the contrary, the inverted u-shaped could not be established between GDPPC and energy consumption, since the coefficient on linear GDPPC is negative in the short-run and squared GDPPC is positive both in the short and long-run. This finding conforms with a study by Bakirtas and Cetin (2017). The result further revealed that both good governance and financial development have a significant negative effect on energy consumption, while human capital appears to have a positive impact on energy consumption. The value of ECT is -0.52 and statistically significant at the usual level which suggests that the rate of adjustment is 0.52% per year.

The interactive coefficients of FDI and good governance (Institutional quality) is negative and statistically significant in both the short run and long run. This outcome is a very encouraging indication for the nation as a whole, as it demonstrates that increased levels of governance have the potential to make a significant contribution to the participation of the country in high-profile initiatives. Concerns about the nation's inadequate governance can be alleviated, and an atmosphere that is favourable to achievement can be cultivated if clear procedures for the selection of investors are put into place. This tactical strategy has a tremendous amount of promise for increasing the proportion of renewable energy projects that are completed successfully. Moreover, this suggests that an improvement in institutional quality has a significant influence on reducing fossil fuel consumption in this region by promoting energy-saving technology. Therefore, an improvement in institutional qualities plays a pivotal role in not only minimizing the detrimental effect of fossil fuel consumption but also helping African countries harness the benefit of FDI towards promoting efficient and clean energy-saving technology. This result is in tandem with the findings of Kumaran et al. (2020), Muhammad et al. (2021), and Sarkodie et al. (2020) who opined that for developing economies to promote the inflow of clean and energy-efficient multinational corporations, there is need to improve the quality of their institution.

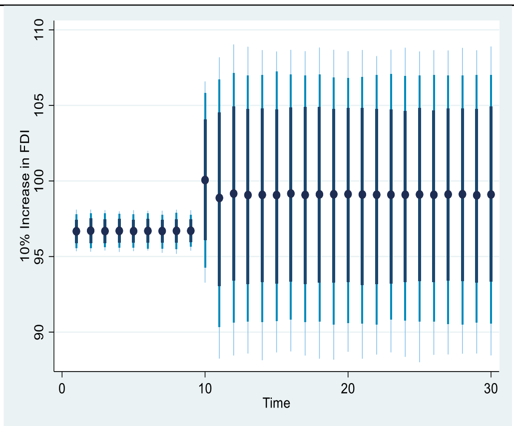
Table 5
*Dynamic ARDL Simulation on the Moderating Effect of Institutional Quality in FDI-Energy Consumption Relationship*

**Dependent Variable: Energy Consumption**

| **Variables** | **Egypt** | **South Africa** | **Mozambique** | **Ghana** |
|---|---|---|---|---|
| ΔFDI | 0.328** | -0.573** | 0.331** | 0.599*** |
| | (0.031) | (0.042) | (0.031) | (0.001) |
| FDI | 0.294** | -0.647** | 0.422** | 0.512 |
| | (0.042) | (0.032) | (0.025) | (0.503) |
| $ΔFDI^2$ | -0.0153** | 0.112** | -0.0671*** | -0.085** |
| | (0.032) | (0.040) | (0.001) | (0.040) |
| $FDI^2$ | -0.0327** | 0.0818*** | -0.0068** | 0.0435*** |
| | (0.042) | (0.001) | (0.031) | (0.003) |
| ΔGDPPC | 0.0869** | 0.0511* | -0.217** | -0.124** |
| | (0.027) | (0.082) | (0.041) | (0.037) |
| GDPPC | 0.0190** | 0.0295* | -0.284*** | -0.0043 |
| | (0.040) | (0.068) | (0.004) | (0.116) |
| $ΔGDPPC^2$ | 0.0028 | -0.0486* | 0.0206** | 0.0335** |
| | (0.401) | (0.071) | (0.043) | (0.028) |
| $GDPPC^2$ | -0.0368** | -0.0286* | 0.0261*** | 0.0306 |
| | (0.041) | (0.062) | (0.003) | (0.146) |
| ΔGOV | -0.0214** | -0.287* | -0.156** | -0.163*** |
| | (0.022) | (0.062) | (0.033) | (0.004) |
| GOV | -0.0862** | -0.347** | -0.298** | -0.121*** |
| | (0.041) | (0.036) | (0.040) | (0.002) |
| ΔFD | 0.0499*** | -0.0083 | 0.0390 | -0.655** |
| | (0.001) | (0.218) | (0.757) | (0.037) |
| FD | 0.0368 | 0.0056 | 0.0908 | -0.116 |
| | (0.452) | (0.230) | (0.747) | (0.310) |
| ΔHC | 0.0468 | 0.2034* | 0.224** | 0.410** |
| | (0.153) | (0.061) | (0.022) | (0.036) |
| HC | 0.363*** | 0.155 | 0.386*** | -0.116 |
| | (0.002) | (0.688) | (0.001) | (0.173) |
| ΔFDI* GOV | -0.0148** | -0.7221** | -0.6273** | -0.0878** |
| | (0.041) | (0.041) | (0.024) | (0.032) |
| FDI* GOV | -0.0135** | -0.2633** | -0.2935** | -0.0912 |
| | (0.031) | (0.026) | (0.042) | (0.028) |
| ECT(-1) | -1.261*** | -0.617** | -1.300*** | -0.527* |
| | (0.004) | (0.046) | (0.002) | (0.071) |
| Obs | 25 | 25 | 25 | 25 |
| R-squared | 0.76 | 0.73 | 0.91 | 0.80 |

Notes: p-values in parentheses: *** p<0.01, ** p<0.05, * p<0.1. FDI = Foreign Direct Investment, GDPPC = GDP per capita, GOV = Good Governance, FD = Financial Development, HC = Human Capital, FDI*GOV = interactive term between FDI and GOV.

The dynamic ARDL simulation will automatically depict the projected value of the actual regressor change as well as its influence on the dependent variable. This is done while maintaining the status quo for the other explanatory variables. The impact of the dependent variables, foreign direct investment, GDP per capita, good governance, financial development, and human capital development on energy consumption is predicted to increase and decrease by 10%. Figure 1(i) to Figure 1(iv) illustrate the impulse response plot for the selected African counties, (i.e., Egypt, South Africa, Mozambique, and Ghana,) which determines the relationship between FDI and energy consumption. The plots reflect the FDI's 10% upward and downward movement and its impression on energy consumption. The number of dots depicts the mean forecast value, whereas the lines reflect the confidence intervals at the 75%, 90%, and 95% levels respectively.

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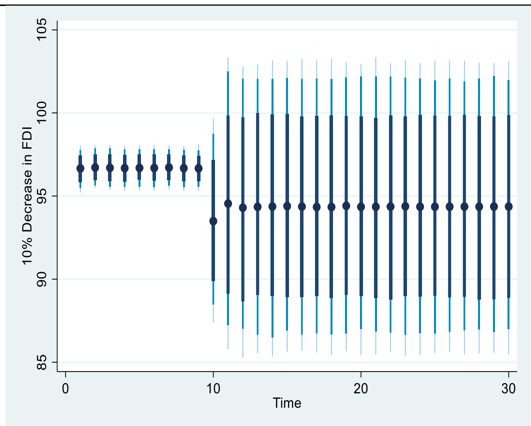
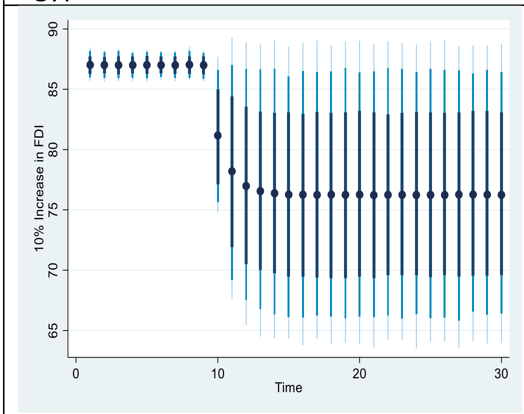



(b)

Figure 1(i): FDI Impulse Response Plot for Egypt

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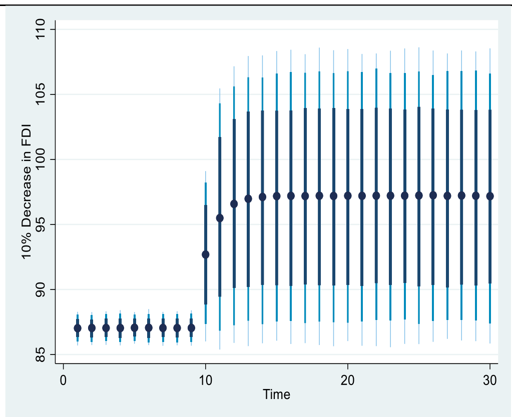
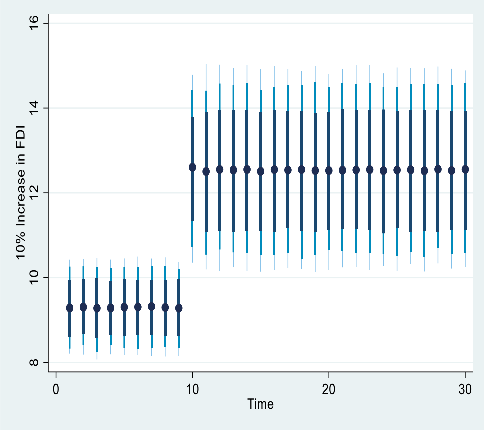



(b)

Figure 1(ii): FDI Impulse Response Plot for South Africa

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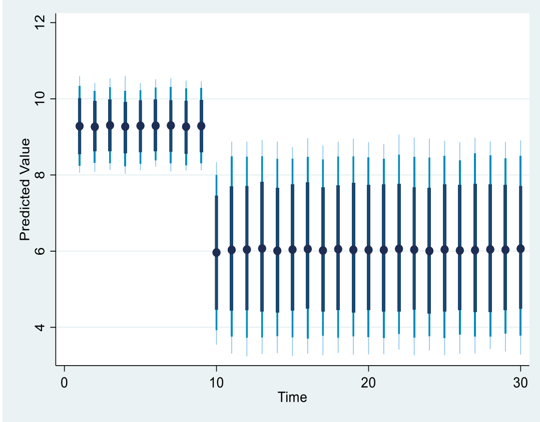
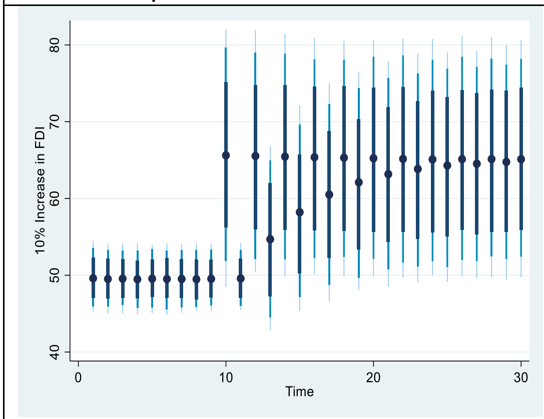



(b)

Figure 1(iii): FDI Impulse Response Plot for Mozambique

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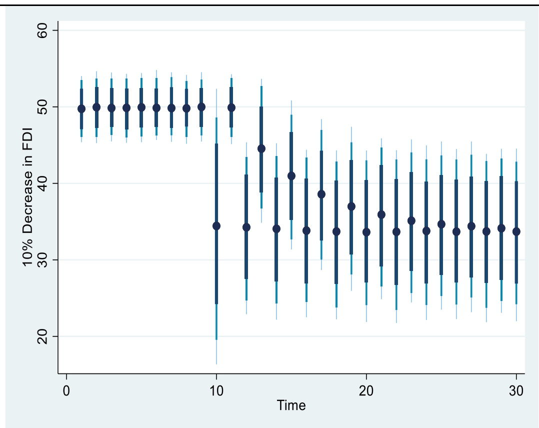



(b)

Figure 1(iv): FDI Impulse Response Plot for Ghana

**ARDL Post Estimation Diagnostics Tests**

Several tests were performed to deal with possible concerns such as serial correlation (the link between variables and their lagged values), autocorrelation, heteroscedasticity, and violation of the normality assumption to ascertain the appropriateness of the dynamic autoregressive lag model. The diagnostic tests, which included the Breusch-Godfrey LM test, Cameron and Trivedi's decomposition of the IM-test, and the Skewness/Kurtosis Tests, were carried out for the selected countries. Table 6 summarizes the findings of these tests.

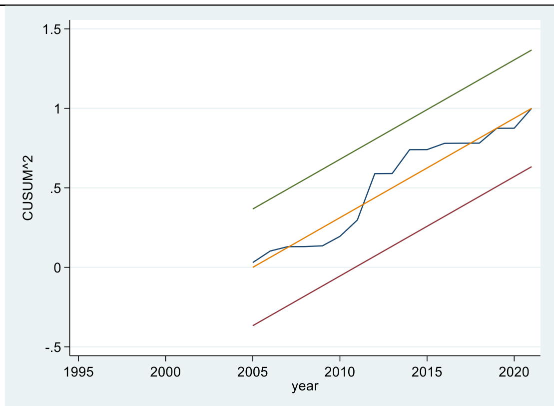
The outcomes of the autocorrelation test that was carried out using the Breusch-Godfrey LM test are detailed in Table 6. According to the findings, the p-value is less than the significance threshold of 5% (the p-value is greater than 0.05), thus, allowing us to reject the hypothesis that there is no serial correlation between variables and their lagged values. As a result, one may get the conclusion that the approximated ARDL residuals for all of the countries that were chosen do not exhibit any autocorrelation. "The decomposition of the IM-test developed by Cameron and Trivedi was utilized to determine whether or not the residuals had heteroskedastic behaviour. Given that the calculated p-value is greater than the significance level of 0.05, it is clear that we are unable to refute the hypothesis of homoscedasticity ($H_0$). As a result, one might conclude that there is no evidence of heteroskedasticity in the residuals.

Furthermore, to test the model's structural stability, the cumulative sum of recursive residuals (CUSUM), and the cumulative sum of recursive residual squares (CUSUMSQ) are employed in this study. The CUSUM and CUSUMSQ visual analyses for the four (4) selected countries are seen in Figure 2(i) to Figure 2(iv). The dimensions of the model are considered to be stable if the plots continue to remain within a critical limit range of five percent. The CUSUM and CUSUMSQ data have been provided below, and they both show that they are less than 5%, which indicates that the parameters have remained the same for the selected countries during all sample periods

Table 6
*Model Diagnostic Test*

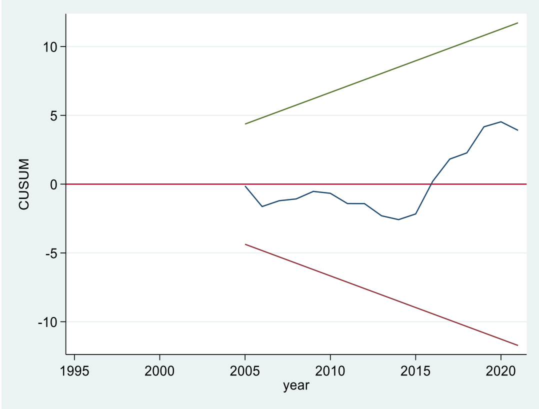
| **Test** | **Egypt** | **South Africa** | **Mozambique** | **Ghana** |
|---|---|---|---|---|
| | $X^2$ *(P-value)* | $X^2$ *(P-value)* | $X^2$ *(P-value)* | $X^2$ *(P-value)* |
| i. Breusch-Godfrey LM test for autocorrelation | 0.6751 | 0.8752 | 0.1424 | 0.2531 |
| ii. Cameron & Trivedi's decomposition of the IM-test | 0.3555 | 0.4297 | 0.5810 | 0.3198 |
| iii. Skewness/Kurtosis tests for normality. | 0.1126 | 0.2527 | 0.2676 | 0.1017 |


(a)




(b)

Figure 2(i): CUSUM and CUSUMSQ Test for Egypt

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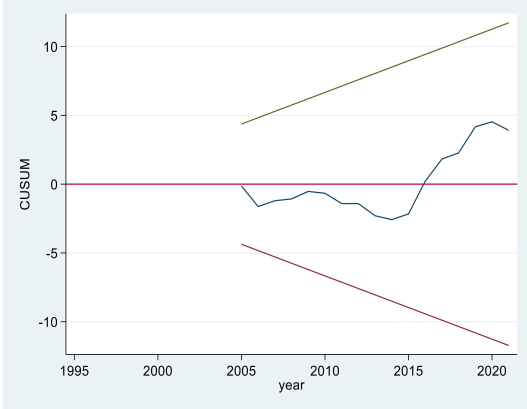
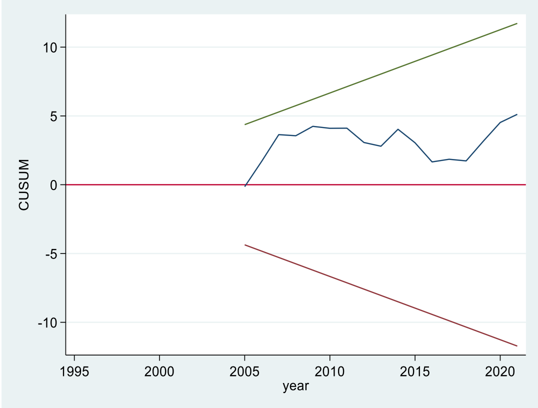



(b)

Figure 2(ii): CUSUM and CUSUMSQ Test for South Africa

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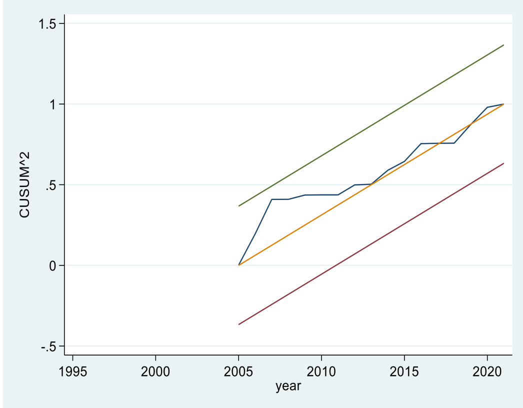
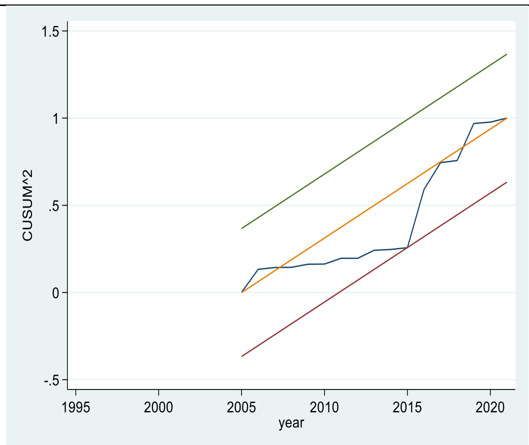



(b)

Figure 2(iii): CUSUM and CUSUMSQ Test for Mozambique


(a)




(b)

Figure 2(iv): CUSUM and CUSUMSQ Test for Ghana

## Conclusion

This study highlights that the influence of FDI on energy consumption is significantly contingent upon the institutional quality in the host nation. Robust institutional frameworks may amplify the beneficial impacts of FDI by promoting the shift to cleaner energy and reducing the environmental impact of economic expansion. The results endorse the perspective that enhancing governance is essential for African nations to optimize the advantages of FDI while fostering sustainable energy consumption habits. These findings corroborate prior research, emphasizing the significance of institutional quality in influencing energy dynamics in emerging countries.

This research makes theoretical and contextual contributions to the economic discourse by elucidating the intricate link among institutional quality, FDI, and energy consumption. The study emphasizes the influence of governance on economic outcomes and the optimization of FDI advantages by incorporating institutional quality as a moderating variable. This methodology is especially significant as it acknowledges that feeble or ineffective institutions can skew the beneficial impacts of FDI, potentially resulting in suboptimal energy use and economic outcomes.

Moreover, the implementation of a non-linear approach to evaluate the Environmental Kuznets Curve (EKC) hypothesis is a significant economic advancement. The conventional EKC model asserts that environmental degradation first escalates with economic expansion but ultimately diminishes when economies attain elevated income levels. This study enhances the theory by integrating non-linear impacts of both FDI and GDP per capita, offering empirical support for the U-shaped relationship between economic growth and environmental impact in African nations. This is crucial for policymakers as it facilitates a deeper comprehension of the interplay between economic growth, foreign investments, and energy consumption patterns, hence allowing for more precise interventions to harmonize economic growth with environmental sustainability.

Furthermore, the study provides context-specific insights into African economies, which are among the foremost recipients of FDI, while considering the institutional heterogeneity throughout the continent. This emphasizes the economic significance of institutional frameworks in regulating FDI inflows, ensuring that these investments result in sustainable energy consumption and economic growth. African economies, frequently confronted with governance issues, might gain from these lessons as they endeavour to attract FDI while addressing energy consumption and environmental consequences.

Finally, the research not only contributes to the expansion of the theoretical discourse concerning the relationship between FDI and energy consumption, but it also comes with practical consequences for economic policy. It provides a platform for future study and policy formation, particularly in developing economies, by establishing a more thorough knowledge of the role that institutions play in promoting sustainable economic growth and energy consumption. This understanding is particularly useful in the context of developing economies. This contribution is essential for the formulation of policies that promote both economic development and environmental sustainability in an economy that is interconnected on a global scale.

**Recommendations**

To optimize the advantages of FDI, especially in advancing renewable energy and reducing dependence on fossil fuels, certain policy measures are required. The subsequent proposals delineate strategic measures that African nations might implement to improve institutional quality, promote sustainable energy development, and attain comprehensive economic and environmental goals.

i. Enhancing Institutional Quality: African countries should strengthen institutional quality, which could mitigate the impact of FDI on energy consumption. Visible regulatory sanctions, traceability, and accountability are important factors in securing financing for change of investments in clean energies or energy demand-reducing technologies.

ii. Support Clean FDI: Policies should encourage environmentally friendly foreign investment with tax holidays and other incentives for investments that benefit from sustainable development. They should encompass policies that are strategic enough to incentivize MNCs towards using cleaner and energy-saving technology.

iii. Finance Sustainable Infrastructure Investments: Financial systems should be redirected to support investments in renewable energy and other clean technologies such as those related to access to safe water, and power distribution; The state and financial institutions should work together to create financing needs, for example by issuing green bonds or providing loans at low interest rates for the private sector to invest in sustainable energy.

iv. Invest in human capital development Countries should allocate resources to ensure the development of their citizens, particularly the youth, who contribute to sectors that promote global energy efficiency.". Training and education in renewable energy, as well as clean or alternative practices, can also decrease our total amount of energy used.

v. Adopt and Implement Strategic Energy Policies: Countries need to adopt and implement robust energy policies that facilitate a transition towards the use of renewable sources. By promoting the use of clean energy alternatives and urging people to conserve electricity, fossil fuels can be used less.

vi. Deliver Clean Energy Policy Goals through Governance Support: Regulators need to enhance governance and provide the right environment that nurtures sustainable energy transactions. This can facilitate the integration of national development efforts toward global sustainability goals such as SDG 7 (Affordable and Clean Energy) – also crucial for SDG 13 (Climate Action), by creating regulatory environments that would be conducive to clean energy.

vii. Promote Regional Collaboration: Since the impact of FDI on energy consumption varies among countries, regional collaboration would facilitate transnational benchmarking and advocacy for clean energy projects. Collaborative research, development, and policy-making will move us to a continent that is using more sustainable energy sources faster.

**Acknowledgements**
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