Gusau Journal of Accounting and Finance (GUJAF)

Vol. 4 Issue 2, October, 2023 ISSN: 2756-665X

A Publication of
Department of Accounting and Finance,
Faculty of Management and Social Sciences,
Federal University Gusau, Zamfara State -Nigeria

Vol. 4 Issue 2
October, 2023
ISSN: 2756-665X

A Publication of
Department of Accounting and Finance,
Faculty of Management and Social Sciences,
Federal University Gusau, Zamfara State -Nigeria

Published and printed by:
Ahmadu Bello University Press Limited, Zaria
Kaduna State, Nigeria.
Tel: 08065949711, 069-879121
e-mail: abupress2013@gmail.com
abupress2020@yahoo.com
Website: www.abupress.com.ng

EDITORIAL BOARD

Department of Accounting, Bayero University Kano, Kano State.

Prof. Muhammad Habibu Sabari
Department of Accounting, Ahmadu Bello University, Zaria.

Prof. Okpanachi Joshua
Department of Accounting and Management, Nigerian Defence Academy, Kaduna.

Prof. Hassan Ibrahim
Department of Accounting, IBB University, Lapai, Niger State.

Prof. Ifeoma Mary Okwo
Department of Accounting, Enugu State University of Science and Technology, Enugu State.

Prof. Aminu Isah
Department of Accounting, Bayero University, Kano, Kano State.

Prof. Ahmadu Bello
Department of Accounting, Ahmadu Bello University, Zaria.

Prof. Musa Yelwa Abubakar
Department of Accounting, Usmanu Danfodiyo University, Sokoto State.

Prof. Salisu Abubakar
Department of Accounting, Ahmadu Bello University Zaria, Kaduna State.

Prof. Isaq Alhaji Samaila
Department of Accounting, Bayero University, Kano State.

Dr. Fatima Alfa
Department of Accounting, University of Maiduguri, Borno State.

Dr. Sunusi Sa'ad Ahmad
Department of Accounting, Federal University Dutse, Jigawa State.

Dr. Nasiru A. Ka'oje
Department of Accounting, Usmanu Danfodiyo University Sokoto State.
Dr. Aminu Abdullahi

Department of Accounting, Usmanu Danfodiyo University Sokoto, State.

Dr. OnipeAdebenege Yahaya
Department of Accounting, Nigerian Defence Academy, Kaduna State.

Dr. Saidu Adamu
Department of Accounting, Federal University of Kashere, Gombe State.

Dr. Nasiru Yunusa
Department of Accounting, Ahmadu Bello University Zaria.

Dr. Aisha Nuhu Muhammad
Department of Accounting, Ahmadu Bello University Zaria.

Dr. Lawal Muhammad
Department of Accounting, Ahmadu Bello University Zaria.

Dr. Farouk Adeza
School of Business and Entrepreneurship, American University of Nigeria, Yola.

Dr. Bashir Umar Farouk
Department of Economics, Federal University Gusau, Zamfara State.

Dr Emmanuel Omokhuale
Department of Mathematics, Federal University Gusau, Zamfara. State

ADVISORY BOARD MEMBERS

CALL FOR PAPERS

The editorial board of Gusau Journal of Accounting and Finance (GUJAF) is hereby inviting authors to submit their unpublished manuscript for publication. The journal is published in two issues of April and October annually. GUJAF is a double-blind peer reviewed journal published by the Department of Accounting and Finance, Faculty of Management and Social Sciences, Federal University Gusau, Zamfara State Nigeria The Journal accepts papers in all areas of Accounting and Finance for publication which include: Accounting Standards, Accounting Information System, Financial Reporting, Earnings Management, , Auditing and Investigation, Auditing and Standards, Public Sector Accounting and Auditing, Taxation and Revenue Administration, Corporate Governance Issues, Corporate Social Responsibility, Sustainability and Environmental Reporting Issue, Information and Communication Technology Issues, Bankruptcy Prediction, Corporate Finance, Personal Finance, Merger and Acquisitions, Capital Structure, Working Capital Management, Enterprises Risk Management, Entrepreneurship, International Business Accounting and Finance, Banking Crises, Bank's Profitability, Risk and Insurance Issue, Islamic Finance, Conventional and Islamic Banks and so forth.

GUIDELINES FOR SUBMISSION AND MANUSCRIPT FORMAT

The submission language is English and must be a well-researched original manuscript that has not previously been submitted elsewhere for publication. The paper should not exceed more than 15 pages on A4 type paper in MS-word format, 1.5-line spacing, 12 Font size in Times new roman. Manuscript should be tested for plagiarism before submission, as the maximum similarity index acceptable by GUJAF is 25 percent. Furthermore, the length of a complete article should not exceed 5000 words including an abstract of not more than 250 words with a minimum of four key words immediately after the abstract. All references including in text citation and reference list, tables and figures should be in line with APA 7th Edition publication manual. Finally, manuscript should be send to our email address elfarouk105@gmail.com and a copy to our website on journals.gujaf.com.ng

PUBLICATION PROCEDURE

After receiving a manuscript that is within the similarity index threshold, a confirmation email will be send together with a request to pay a review proceeding fee. At this point, the editorial board will take a decision on accepting, rejecting or making a resubmission of the manuscript based on the outcome of the double-blind peer review. Those authors whose manuscript were accepted for publication will be asked to pay a publication fee, after effecting all suggested corrections and changes made on the manuscript. All corrected papers returned within the specified time frame will be published in that issue.

PAYMENT DETAILS
Bank: FCMB
Account Number: 7278465011
Account Name: Gusau Journal of Accounting and Finance

FOR INQUIRY
The Head,
Department of Accounting and Finance,
Federal University Gusau, Zamfara State.
elfarouk105@gmail.com
+2348069393824

FOR MORE INFORMATION, CONTACT
The Editor-in-Chief on +2348067766435
The Associate Editor on +2348036057525
OR visit our website on www.gujaf.com.ng or journals.gujaf.com.ng

CONTENTS

DOI: https://doi.org/10.57233/gujaf.v4i2.10

FOREIGN DIRECT INVESTMENT, RENEWABLE ENERGY AND ECONOMIC GROWTH: AN EMPIRICAL ANALYSIS FROM SOUTH AFRICA

Ahmed Oluwatobi Adekunle
Department of Accounting Science
Kwara State University, Malete[1]
Walter Sisulu University, South Africa[2]

Abstract

This paper explores the connection amid renewable energy, FDI and economic growth in South Africa using the vector error correction model (VECM) and exogeneity granger causality test. The data employed in this study covered 1990-2020, all obtainable from World development indicator (WDI) and International Energy Agency (IEA). The results revealed that a significant causal connection from economic growth to renewable energy is observed over the long-run while renewable energy does not granger cause economic growth, a uni-directional causality exist amid the economic growth and renewable energy. The study recommends that the government should offer some sort of help to make sure organizations or companies are adequately influenced to depend largely on renewable energy which will facilitate ecological friendly system in the country.

Keywords: FDI, Renewable energy, Growth, South Africa, VECM

1. Introduction

Climate change has become one of the most urgent issues facing the planet, particularly in recent decades. Human-caused carbon-emissions from energy creation and usage are the primary factor causing climate change, mostly CO_2 emissions are attributable to the usage of non-renewable elements such as coal and fossil fuels facedrise in usage in recent time. Since 1755, 399.8 billion tonnes of CO_2 released to the environment as a result of usage of cement production and usage of fossil fuels in production activities (IEA, 2016). According to Can et al. (2019), significant level of this CO_2has emerged in the meantime, 1980s.However, one of the most certain means of attaining the global climate targets is through the use of renewable energy. Renewable energy (REn), as opposed to non-renewable fuels, improves the environment, the economy, and energy security (IEA, 2016).Energy resources must be consumed in order for nations to experience economic growth (Y). Research on climate change should therefore take into account the connection amid CO_2, energy consumption (including total energy, non-renewable energy (NREn) and REn, and economic growth (EcGr).

Many study subjects in the empirical work on energy finance make use of econometric techniques such as cointegration, causation, and unit root. According to the Environmental Kuznets Curve (EKC) theory, ecologicaldilapidation rises along with economic advancement until it crosses a certain edge, at which point it falls (Adekunle et al., 2023; Bekun et al., 2023).The second is the Pollution Halo Hypotheses (PHH), which looks at how CO2 and foreign direct investment are related. According to the PHH, wealthy nations with strong environmental policies gravitate towards those with lax environmental laws (Zeraibiet al., 2019; AlNemer et al., 2023). On the other hand, the PHH contends that FDI results in a cleaner environment since advanced technology and superior management are transferred to the host country (Ahmed et al., 2019; Djellouli et al., 2023; Pao et al., 2013).

2. Empirical Review

Several advanced econometric methods employed in several studies in the energy finance to examine the connection among NREnREn, urbanization, EcGr and FDI. Yet, there are stock-still no conclusive findings in this area from researchers. Researchers that are looking to solve these difficulties opt to multi-data analysis rather than single country analysis because issues related to level of data frequencies may occur in the analysis especially in time series. Additionally, according to Shahbaz et al. (2020), the ARDL methodology is the most often utilised technique for assessing the EKC hypothesis. The ARDL technique put forth by Pesaran et al. (1999) has several drawbacks, though. For instance, the limit test presupposes that there is no feedback amid the exogenous and endogenous variables. As a result, the ARDL test encounters the endogeneity problem (Tuna et al., 2019).

Basically, an increase in environmental consciousness brought on by international agreements like the Kyoto Protocol or Paris Agreement has led to an increase in the number of scholars conducting studies on climate change issues. In a world where climate regulations are becoming more common, researchers continue to look into the causes of environmental degradation. Three categories are used by Grossman and Krueger to categories the variations in contamination levels. Environmental pollution increases during the initial stage of development (i.e., as GDP grows) as a result of increased production and resource use. Scale effects become apparent as a result (Appiah-Otoo et al., 2023; Akadiriet al., 2019). Second, the composition effect is particularly noticeable in the shift from industrial sectors that require more intensive energy resources to environmentally friendly sectors, particularly in those nations that have made the knowledge economy transition (Shahbaz et al., 2019). Finally, thanks to technical advancements, manufacturers progress towards a clean

production method. As a result, technology prevents the environment from degrading (Sunet al, 2022).

The literature supports the EKC theory (Bilgili et al., 2016; Pata, 2018; Destek et al., 2019), although other empirical works (Pata, 2018; Belloumi, 2009; Zhang et al., 2023; Sharif et al., 2019) have reached the opposite conclusion, contending that the indication does not backing this supposition. The choice of the nations, the time frame, the differences between the model variables, the selection of the quadratic or cubic EKC model, the demographics of the studied country, and the use of econometric techniques are some of the factors that contribute to this ambiguity in the literature. Ocal et al. (2013) and Sarkodie (2018) have noticed that when the EKC is evaluated for the same country, various results are accessed even in study. In this case, Ozturk et al. (2015) suggest that researchers should use novel econometric methodologies and alternate viewpoints in order to obtain more accurate and consistent results.

Because countries with loose environmental laws are appealing to those with sterneco friendly guidelines, climate dereliction in the host country may intensify and demonstrate the scale effect (Sarkodie et al., 2018). Moreso, ecological advances and innovative technologies transfer can stimulate ecology friendly system in the host nation. As a result, the scale effect proves the Pollution Halo Hypothesis (PHH), while the composition and technology effects also support the PHH (Xu et al., 2020; Maji et al., 2019). On the question of whether FDI inflows can hasten ruin of the environment in the host country, there is no consensus. The pollution halo hypothesis, which holds that FDI influx will lower ecological pollution through high technical transfer to the host country, is correct, according to various research (Fan et al., 2020; Maji et al., 2019; Rafindadi et al., 2017; Baz et al., 2021). Essentially, many studies (Yildirim et al., 2012; Yilcan et al., 2019; Usama et al., 2020; Dogan et al., 2020; Pata, 2021; Shahbaz et al., 2019) corroborate the soundness of the PHH.

Essentially, this current study revisits the claims of PHH for South Africa economy using VECM, Cointegration analysis and causality method. The study aims to find whether the PHH holds for South Africa given the current energy situation of the country viz-a-viz foreign direct investment.

3. Methodology

Theoretically, magnitude, composition, and method effects are how FDIs affect REC and EG. According to the scale effect, foreign direct investments (FDIs)

impede the development of renewable energy by encouraging the transmission of dirty energy technologies for industrial uses, typically during the early stages of economic expansion, which are frequently typified by a rampant use of dirty energy (Suki et al., 2020). However, because of the severe environmental burdens associated with the use of dirty energy, manufacturing processes are starting to shift in the direction of more ecologically maintainable practices through reallocation of resources. According to the method effect, FDI speeds up REC through accelerating economic growth, typically through the transference of sustainable advanced machineries, expertise and free market accessibility, researchers like (Qamruzzaman et al., 2022; Tiwari et al., 2022) providing empirical support for the method effect, whereas (Khan et al., 2022) for 69 Belt and Road nations have provided empirical support for the scale effect.

Essentially, following the theoretical relationship established above, this study formulates the empirical model as

$GDP = f(FDI, REN, IMP, EXP)$ (1)

Where GDP = gross domestic product

REN = renewable energy consumption

FDI = Foreign Direct Investment

IMP = Import

EXP = Export

The econometric specification of the model is specified below:

$GrDP = REWE + FDIv + EXPT + IMPT$ (3)

$GrDP = \beta_0 + \beta_1 REWE + \beta_2 FDIv + \beta_3 EXPT + \beta_4 IMPT$ (4)

$GrDP = \beta_0 + \beta_1 REWE + \beta_2 FDIv + \beta_3 EXPT + \beta_4 IMPT + \varkappa$ (5)

$GrDP = \beta_0 + \beta_1 REWE + \beta_2 FDIv + \beta_3 EXPT + \beta_4 IMPT + \hat{e}$ (6)

GrDP is the endogenous variable while REWE, FDIv, EXPT and IMPT are the exogenous variables. Equation (6) is modelled to show the connection amid GDP and other specified variables in South Africa (SA). $\beta_0 - \beta_4$ are the parameters to be estimated in the model.Essentially, this study will employ VECM and granger causality test to validate the current connection amid FDIv, REWE and GrDP for South Africa economy. The data employed are secondary data source from WDI

4. Findings and Discussions

Unit Root Test

Table 1 presents the unit root test in order to ascertain the order of integration of the variables. As shown by both ADF and DF-GLS test. The Table confirmed that the variables are I(0) and I(1) order.

Table 1: Unit Root Testing

		ADF Null (H_0): Non-stationary				DF-GLS Null (H_0): Non-stationary			
		ADF_α				ERS_α			
	$z_{.t}$	$\tau_{.\mu}$	1%	5%	Prob.	τ_τ	1%	5%	Prob.
Intercept without Time Trend	REN	-1.62	-3.67	-2.97	0.45	-1.35	-2.65	-1.95	0.18
	GDP	-1.59	-3.57	-2.97	0.47	-1.37	-2.65	-1.95	0.18
	IMP	-1.51	-3.67	-2.96	0.51	1.09	-2.65	-1.95	0.28
	EXP	-3.06	-3.67	-2.96	0.04	2.83	-2.64	-1.95	0.00
	FDI	-2.73	-3.68	-2.97	0.08	-1.83	-2.65	-1.95	0.08
	ΔREN	-2.67	-3.67	-2.96	0.04	-2.21	-2.65	-1.95	0.03
	ΔGDP	-3.44	-3.67	-2.97	0.01	-3.52	-2.65	-1.95	0.00
	ΔIMP	-3.36	-3.67	-2.97	0.02	-4.57	-2.60	-1.95	0.00
	ΔEXP	-6.31	-3.69	-2.97	0.00	-8.97	-2.65	-1.95	0.00
	ΔFDI	-5.09	-3.69	-2.98	0.00	-7.03	-2.65	-1.95	0.00
Intercept with Time Trend	REN	-0.89	-4.30	-3.57	0.94	-1.53	-3.77	-3.19	0.13
	GDP	-3.44	-3.68	-2.97	0.01	-3.52	-2.65	-1.95	0.00
	IMP	-0.34	-4.29	-3.57	0.98	-1.45	-3.77	-3.19	0.16
	EXP	-5.24	-4.29	-3.57	0.00	-5.43	-3.77	-3.19	0.00
	FDI	-3.43	-4.30	-3.56	0.06	-3.54	-3.77	-3.19	0.00
	ΔREN	-2.75	-4.30	-3.57	0.04	-2.64	-3.77	-3.19	0.01
	ΔGDP	-3.43	-4.31	-3.57	0.05	-3.59	-3.77	-3.19	0.00
	ΔIMP	-3.61	-3.77	-3.57	0.05	-3.77	-3.77	-3.19	0.00
	ΔEXP	-6.19	-4.32	-3.58	0.00	-6.42	-3.77	-3.19	0.00
	ΔFDI	-6.05	-4.34	-3.59	0.00	-7.31	-3.77	-3.19	0.00

Source: Author's Compilation, 2023

The Table 1 above represents the unit root test which shows that all the variables were not stationary at level. Essentially, the study ensure stationarity of the variables used at I(0) and I(1) which necessitate the use of Vector Error Correction Model (VECM).

Selection of Lags

The optimum lag selection is established in Table 2 below, in order to avoid spurious regression analysis as this can lead to misguided validations. Since, the OpLS is established at 1 following the Schwarz information criterion. The estimation of Johansson cointegration test and thereafter the VECM procedure is established.

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-713.9068	NA	5.86e+16*	52.77906*	53.96852*	53.14269*
2	-697.0882	21.62385	1.22e+17	53.36345	55.74238	54.09071
3	-678.4363	17.31962	3.03e+17	53.81688	57.38529	54.90778

Source: Author's Compilation, 2023

Johansen Cointegration Test (JCT)

JCT was used in the study to determine the long-term relationships between the variables. It will be employed in this study since Johansen's (1999) method provides the greatest likelihood for finite-order vector auto-regressions (VARS) and is simple to compute for such systems. The outcome is displayed in Table 3 below.

Table 3: Test of Unrestricted Cointegration (Trace).

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.763558	89.50430	69.81889	0.0006
At most 1	0.521311	47.68484	47.85613	0.0519
At most 2	0.362173	26.32041	29.79707	0.1194
At most 3	0.274975	13.27947	15.49471	0.1049
At most 4 *	0.127474	3.954533	3.841466	0.0467

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

Source: Author's Compilation, 2023

Table 4: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.763558	41.81947	33.87687	0.0046
At most 1	0.521311	21.36442	27.58434	0.2548
At most 2	0.362173	13.04094	21.13162	0.4485
At most 3	0.274975	9.324938	14.26460	0.2601
At most 4 *	0.127474	3.954533	3.841466	0.0467

Eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
Source: Author's Compilation, 2023

There exista long run stable cointegration relations among the variables, as shown in Table 4 above, in both the trace and maximum eigenvalue tests. VEC modelling can be carried out in further detail based on the assumption that cointegration linkages exist.

Vector Error Correction Model (VECM)

It should be emphasized that the error correction mechanism (ECM) aims to link the cointegrating equations' short-run dynamics to their long-run static dispositions. The Vector Error Correction Method (VECM) was used to capture the short run variation, and the outcome is shown in Table 5 below. This model is estimated in the study so that causality and diagnostic tests can be performed.

Table 5: VECM Output

Cointegrating Eq:	**CointEq1**				
GDPC(-1)	1.000000				
REN(-1)	-1.77E+10				
	(8.9E+09)				
	[-1.99567]				
FDI01(-1)	6.14E+10				
	(1.2E+10)				
	[5.08572]				
LOGEXP(-1)	-2.87E+11				
	(3.8E+10)				
	[-7.59992]				

LOGIMP(-1)	-1.20E+11				
	(6.9E+10)				
	[-1.74535]				
C	8.73E+12				
Error Correction:	**D(GDPC)**	**D(REN)**	**D(FDI01)**	**D(LOGEXP)**	**D(LOGIMP)**
CointEq1	-0.015292	4.17E-13	-5.94E-12	6.64E-12	-8.89E-13
	(0.02521)	(2.6E-12)	(4.3E-12)	(1.7E-12)	(4.9E-13)
	[-0.60661]	[0.15820]	[-1.37592]	[3.81632]	[-1.81009]
D(GDPC(-1))	0.353444	-1.99E-11	1.22E-10	7.47E-12	-9.69E-12
	(0.51566)	(5.4E-11)	(8.8E-11)	(3.6E-11)	(1.0E-11)
	[0.68542]	[-0.36854]	[1.37993]	[0.20980]	[-0.96400]
D(GDPC(-2))	-0.112474	5.39E-11	-9.95E-11	-6.19E-12	-3.49E-12
	(0.47356)	(5.0E-11)	(8.1E-11)	(3.3E-11)	(9.2E-12)
	[-0.23751]	[1.08682]	[-1.22738]	[-0.18929]	[-0.37826]
D(REN(-1))	-6.08E+09	0.483612	-0.372945	0.328021	-0.169683
	(2.6E+09)	(0.27625)	(0.45156)	(0.18225)	(0.05143)
	[-2.30283]	[1.75063]	[-0.82589]	[1.79983]	[-3.29954]
D(REN(-2))	-1.25E+08	0.269139	0.394295	0.489052	-0.077642
	(3.4E+09)	(0.35838)	(0.58582)	(0.23644)	(0.06672)
	[-0.03643]	[0.75098]	[0.67306]	[2.06843]	[-1.16376]
D(FDI01(-1))	-1.96E+08	-0.043264	-0.21145	-0.205907	0.026499
	(1.2E+09)	(0.12839)	(0.20987)	(0.08470)	(0.02390)
	[-0.15940]	[-0.33697]	[-1.00755]	[-2.43096]	[1.10873]
D(FDI01(-2))	-7.19E+08	-0.068376	-0.043313	-0.115323	-0.013134
	(1.0E+09)	(0.10553)	(0.17251)	(0.06962)	(0.01965)
	[-0.71271]	[-0.64791]	[-0.25108]	[-1.65637]	[-0.66851]
D(LOGEXP(-1))	-2.28E+09	0.065392	-1.210733	0.523011	-0.165316
	(5.1E+09)	(0.53808)	(0.87956)	(0.35499)	(0.10017)
	[-0.44304]	[0.12153]	[-1.37652]	[1.47331]	[-1.65038]
D(LOGEXP(-2))	-1.81E+09	0.067441	-0.421609	0.253318	-0.071923
	(3.3E+09)	(0.34929)	(0.57096)	(0.23044)	(0.06502)
	[-0.54152]	[0.19308]	[-0.73843]	[1.09929]	[-1.10611]

D(LOGIMP(-1))	1.51E+09	0.089798	-0.735266	2.797161	0.118234
	(1.7E+10)	(1.79912)	(2.94087)	(1.18693)	(0.33492)
	[0.08780]	[0.04991]	[-0.25002]	[2.35664]	[0.35302]
D(LOGIMP(-2))	-2.23E+09	0.155535	1.333078	0.572628	-0.292815
	(1.5E+10)	(1.56052)	(2.55086)	(1.02952)	(0.29050)
	[-0.14983]	[0.09967]	[0.52260]	[0.55621]	[-1.00796]
C	2.55E+09	-0.289186	0.171907	0.092179	0.072272
	(2.8E+09)	(0.28861)	(0.47176)	(0.19040)	(0.05373)
	[0.92376]	[-1.00200]	[0.36439]	[0.48412]	[1.34518]
R-squared	0.445210	0.395595	0.551586	0.678931	0.542715
Adj. R-squared	0.063792	-0.019933	0.243301	0.458195	0.228332
Sum sq. resids	7.42E+20	8.134425	21.73497	3.540449	0.281896
S.E. equation	6.81E+09	0.713023	1.165519	0.470402	0.132735
F-statistic	1.167250	0.952030	1.789207	3.075768	1.726285
Log likelihood	-665.8673	-22.42489	-36.18433	-10.77897	24.64763
Akaike AIC	48.41909	2.458920	3.441738	1.627069	-0.903402
Schwarz SC	48.99004	3.029865	4.012683	2.198014	-0.332457
Mean dependent	5.62E+09	-0.307143	0.244462	0.043126	0.044421
S.D. dependent	7.04E+09	0.706021	1.339855	0.639069	0.151102
Determinant resid covariance (dof adj.)		3.30E+16			
Determinant resid covariance		2.01E+15			
Log likelihood		-691.9618			
Akaike information criterion		54.06870			

Source: Author's Compilation, 2023

Table 6: Stability test for VECM

Lags	LM-Stat	Prob
1	13.92668	0.963
2	30.51903	0.2054
Probs from chi-square with 25 df.		

Source: Author's Compilation, 2023

Granger Causality Test

The results of the cointegration test shows a stable link over time between the two variables such as FDI, renewable energy and economic growth, but more research is required to determine whether there is a causal connection. When the regression of EcGr is based on previous values of EcGr and past values of FDI are added, the independence power of the regression can be considerably increased if variable EcGr is useful in predicting EcGr. If so, FDI is the Granger cause of FDI; otherwise, it is the non-Granger cause. P value is below the 5% level of significance, indicating that the null hypothesisthat Granger causality existsmust be accepted.

Table 7: Granger Causality Output

Null Hypotheses (H0)	Chi-Square	Probability	Remarks
GDPC does not Granger Cause REN	5.31	0.07	Uni-directional Causality (UDC)
REN does not Granger Cause GDPC	1.19	0.55	
GDPC does not Granger Cause FDI	0.55	0.70	no-directional Causality (UDC)
FDI does not Granger Cause GDPC	2.40	0.30	
GDPC does not Granger Cause EXP	0.30	0.80	No Causality
EXP does not Granger Cause GDPC	0.05	0.97	
GDPC does not Granger Cause IMP	0.02	0.89	No Causality
EXP does not Granger Cause GDPC	1.69	0.42	

Source: Author's Compilation, 2023

In summary, as the results shown in Table 7 above, there is no bidirectional granger causality among any of the variables. However, there is Unidirectional Causality

between GDPC and REN which is supported by previous studies such as Adekunle et al., 2023a, Adekunle et al., 2023b and Kiliçarslan, 2019.

5. Conclusion and Recommendations

The connection amid FDI, Ren and EcGr for the South African economy from 1990 to 2020 was examined in this paper. The study determined that GDP granger causes REN in the South African economy, but REN does not granger cause GDP. The sightings of this study establish the GDP growth potential of the REC-EG nexus. Therefore, policies that encourage South Africa's GDP growth ought to be given top priority. Thorough general and local policy had better develop for the implementation and expansion of REn. The regional governments' lawmaking bodies should implement the required action to create a strong framework for environmental sustainability that overcomes the current obstacles to sustainability adoption. Incentives and a supportive environment for thriving domestic manufacturing of RE technologies and the parts they require could be included in policies, but this is not the only option. To facilitate the best adoption and use of RE, policymakers must put various strategic measures into place. For instance, education can increase knowledge about RE's existence, application, and importance. Education laws that mandate the inclusion of energy courses, particularly RE, in academic curricula should be established by policymakers. This would enable both the current generation and succeeding ones to implement and accommodate the usage of REn. Additionally, the cost of RE deters firms, especially big enterprises, from implementing and utilising it. Large upfront expenses are associated with the majority of corporate and private RE programmes, which discourages people from taking part. The government must offer some sort of help to make sure organisations or companies are adequately influenced to depend largely on Ren which will facilitate ecological friendly system in the country.

The study is constrained by the following factors. The results of this study cannot be used to reflect the economies of other nations in the sub-region because it exclusively focused on South Africa. As a result, later studies may include more sub-regions to increase the study's reach. Additionally, this study ignored sub-measures of RE like solar and wind energy and utilised REC as the only measure of RE. Therefore, the sub-components of RE should be used in additional investigations in the future. Additionally, this analysis focused on total FDI. In light of this, future investigations may employ the portion of FDI to RE for additional research. Lastly, although this study focused on the aggregate dataset, there are regional variances in economic growth, export, foreign direct investment, and

import. So that effective multi-country policies may be created, imminentwork can conduct studies that are panel in nature.

References

Adekunle, A. O., Bekun, F. V., Gbadebo, A. D., Akande, J. O. (2023). Empirical analysis of South African's urbanization growth and export demands: implications for environmental sustainability. Environmental Science and Pollution Research, 41(1)

Adekunle A. O, Abdulmumin B. A, Akande J. O, Ajose K. G (2022) Modelling aggregate energy consumption for growth in Nigeria. International Journal Energy Econonomics Policy, 12(6):389–395. https:// doi. org/ 10. 32479/ijeep. 13829

Adekunle, A. O. (2023a). Foreign direct investment, non-renewable energy and economic growth: An empirical analysis from South Africa. Reviews of Management Sciences, 5(2), 54-69.

Adekunle, A. O. (2023a). Sustainable connection amid renewable energy, non-renewable energy usage and economic growth in South Africa. Reviews of Management Sciences, 5(2), 1-15.

Ahmed M., Azam, M. (2016). Causal nexus between energy consumption and economic growth for high, middle and low income countries using frequency domain analysis. Renewable and Sustainable Energy Review, 60(6), 53–78. https://doi.org/10.1016/J. RSER.2015.12.174.

Akadiri, S. S., Alola, A.A., Usman, O. (2021), Energy mix outlook and the EKC hypothesis in BRICS countries: A perspective of economic freedom vs. Economic growth. Environmental Science and Pollution Research, 28, 8922-8926

AlNemer, H., Hkiri, B., Tissaoui, K. (2023). Dynamic impact of renewable energy and non-renewable energy on CO_2 emission and economic growth in Saudi Arabia: Fresh evidence from wavelet coherence analysis. Renewable Energy, 209(1), 340-356.

Appiah-Otoo, I., Chen, X., Ampah, J. (2023). Exploring the moderating role of foreign direct investment in the renewable energy and economic growth nexus: Evidence from West Africa. Energy, 281(2), 1-11.

Baz, K., Cheng, J., Xu, D., Abbas, K., Ali, I., Ali, H. (2021), Asymmetric impact of fossil fuel and renewable energy consumption on economic growth: A non-linear technique. Energy, 226, 120357.

Belloumi, M. (2009). Energy consumption and GDP in Tunisia: co-integration and causality analysis. Energy Policy, 37(1), 2745–53.

Bekun, F. V., Adekunle, A. O., Gbadebo, A. D., Abdulkareem, A., Akande, J. O., Nora, Y. (2023). Sustainable electricity consumption in South Africa: the impacts of tourism and economic growth. Environmental Science and Pollution Research, 40(1), 1-11.

Bilgili, F., Ozturk, I. (2015). Biomass energy and economic growth nexus in G7 countries: evidence from dynamic panel data, Renew. Sustain. Energy Rev. 49, 132-138

Can, H., Korkmaz, Ö. (2019), The relationship between renewable energy consumption and economic growth the case of Bulgaria. International Journal of Energy Sector Management, 11, 1-12.

Destek, M. A., Sinha, A. (2020). Renewable, non-renewable energy consumption, economic growth, trade openness and ecological footprint: evidence from organisation for economic Co-operation and development countries. Journal of Cleaner Production, 242 (2), 118537.

Dogan, E., Ulucak, R., Kocak, E., Isik, C. (2020). The Use of Ecological Footprint in Estimating the Environmental Kuznets Curve Hypothesis for BRICST by Considering Cross-Section Dependence and Heterogeneity, Science of The Total Environment, 138063

Fan, W., Hao, Y. (2020), An empirical research on the relationship amongst renewable energy consumption, economic growth and foreign direct investment in China. Renewable Energy, 146, 598-609.

IEA. (2016), World Energy Outlook 2017. Vol. 8. France: International Energy Agency, OECD. p1-569.

Khan, A., Chenggang, Y., Hussain, J., Kui, Z. (2021). Impact of technological innovation, financial development and foreign direct investment on renewable energy, non-renewable energy and the environment in belt & Road Initiative countries. Renewable Energy, 171:479–91. https://doi.org/10.1016/J.RENENE.2021.02. 075.

Kilicarshan, Z. (2019). The Relationship between Foreign Direct Investment and Renewable Energy Production: Evidence from Brazil, Russia, India, China, South Africa and Turkey. International Journal of Energy Economics and Policy, 9(4), 291-297.

Maji, I. K., Sulaiman, C., Abdul-Rahim A. S. (2019). Renewable energy consumption and economic growth nexus: a fresh evidence from West Africa. Energy Rep, 5(1) 384–92. https://doi.org/10.1016/J.EGYR.2019.03.005

Ocal, O., Aslan, A. (2013), Renewable energy consumption-economic growth nexus in Turkey. Renewable and Sustainable Energy Reviews, 28, 494-499.

Ozcan, B., Ozturk I. (2019). Renewable energy consumption-economic growth nexus in emerging countries: a bootstrap panel causality test. Renew Sustain Energy Rev, 104, 30–7. https://doi.org/10.1016/J.RSER.2019.01.020

Ozturk, I., Al-Mulali, U. (2015). Investigating the validity of the environmental Kuznets curve hypothesis in Cambodia. Ecological Indicators, 57, 324-330.

Pata, U. K. (2021). Linking renewable energy, globalization, agriculture, CO2 emissions and ecological footprint in BRIC countries: a sustainability perspective, Renew. Energy 173 (2) 197–208.

Pao, H., Fu, H. (2013). Renewable energy, non-renewable energy and economic growth in Brazil. Renewable and Sustainable Energy Reviews, 25(1), 381-392.

Pata, U. K., Caglar, A. E. (2021). Investigating the EKC hypothesis with renewable energy consumption, human capital, globalization and trade openness for China: evidence from augmented ARDL approach with a structural break. Energy 216 (1), 119220

Pata, U. K. (2018). Renewable energy consumption, urbanization, financial development, income and CO2 emissions in Turkey: testing EKC hypothesis with structural breaks. Journal of Cleaner Production, 187 (2) 770-779.

Pesaran, H. M., Shin, Y., Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels, J. Am. Stat. Assoc. 94 (446), 621-634.

Qamruzzaman, M., Karim, S., Jahan I. (2022). Nexus between economic policy uncertainty, foreign direct investment, government debt and renewable energy consumption in 13 top oil importing nations: evidence from the symmetric and asymmetric investigation. Renewable Energy, 195:121–36. https://doi.org/10.1016/J. RENENE.2022.05.168

Rafindadi, A. A., Ozturk, I. (2017), Impacts of renewable energy consumption on the German economic growth: Evidence from combined cointegration test. Renewable and Sustainable Energy Reviews, 75, 1130-1141.

Sarkodie, S. A. (2018). The invisible hand and EKC hypothesis: what are the drivers of environmental degradation and pollution in Africa? Environmental Science and Pollution Control Service, 25 (22), 21993-22022

Sarkodie, S. A., Adams, S. (2018). Renewable energy, nuclear energy, and environmental pollution: accounting for political institutional quality in South Africa. Science of Total Environment, 643 (1) 1590-1601

Shahbaz M, Sinha A, Raghutla C. (2022). Decomposing scale and technique effects of financial development and foreign direct investment on renewable energy consumption. Energy 15(2), 238:121758. https://doi.org/10.1016/J. ENERGY.2021.121758

Shahbaz, M., Raghutla, C., Chittedi, K.R., Jiao, Z.(2020), The effect of renewable energy consumption on economic growth: Evidence from the renewable energy country attractiveindex. Energy, 207, 1-58.

Sharif, A., Raza, S. A., Ozturk, I., Afshan, S. (2019). The dynamic relationship of renewable and nonrenewable energy consumption with carbon emission: a global study with the application of heterogeneous panel estimations. Renewable Energy, 133 (1) 685-691.

Suki, N. M., Sharif, A., Afshan, S., Suki, N. M. (2020). Revisiting the Environmental Kuznets Curve in Malaysia: the role of globalization in sustainable environment. Journal of Cleaner Production. 301(1), 121669.

Tiwari., A. K., Nasreen, S., Anwar, M. A. (2022). Impact of equity market development on renewable energy consumption: do the role of FDI, trade openness and economic growth matter in Asian economies? Journal of Cleaner Production, 334:130244. https://doi. org/10.1016/J.JCLEPRO.2021.130244.

Tuna, G., Tuna, V.E. (2019), The asymmetric causal relationship between renewable and non-renewable energy consumption and economic growth in the ASEAN-5 countries. Resources Policy, 62, 114-124.

Usama, A. M., Solarin, S. A., Salahuddin, M. (2020). The prominence of renewable and non-renewable electricity generation on the environmental Kuznets curve: a case study of Ethiopia, Energy, 211 (2), 118665.

Xu, C., Zhao, W., Zhang, M., Cheng, B. (2020). Pollution haven or halo? the role of the energy transition in the impact of FDI on CO2 Emissions. Science of The Total Environment, 80, 143002.

Yildirim, E., Sarac, S., Aslan, A. (2012). Energy consumption and economic growth in the USA: evidence from renewable energy. Renewable and Sustainable Reviews, 16(2), 1-11.

Zeraibi, A., Balsalobre-Lorente, D., Murshed, M. (2021). Nexus between renewable electricity generation capacity, technological innovations, financial development, economic growth and ecological footprints in selected ASEAN countries, Environmental Science and Pollution Control Service, https://doi.org/10.1007/s11356-021-14301-x.