International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2024, 14(6), 222-229.

Renewable Energy Consumption in Somalia: Assessing Its Impact on Currency Exchange Rates

Iqra Hassan Mohamud[1]*, Zakarie Abdi Warsame[2], Ahmed Abdirashid Mohamud[3], Abas Mohamed Hassan[1], Ibrahim Hassan Mohamud[1]

[1]Faculty of Management Sciences, SIMAD University, Mogadishu, Somalia, [2]Faculty of Economics, SIMAD University, Mogadishu, Somalia, [3]Faculty of Accountancy, Simad University, Mogadishu, Somalia. *Email: iqrook99@gmail.com

Received: 14 January 2024 **Accepted:** 26 August 2024 **DOI:** https://doi.org/10.32479/ijeep.15699

ABSTRACT

This study utilizes an Autoregressive Distributed Lag (ARDL) model to examine the effects of renewable energy, economic growth, and inflation rate on exchange rate fluctuations in Somalia from 1990 to 2019. The analysis shows that economic growth and RE positively influence the exchange rate in both the short and long run. In contrast, inflation negatively impacts the exchange rate in the short run, suggesting short-term currency appreciation, but leads to depreciation in the long term. Moreover, the study finds that a 1% increase in RE results in an 80% increase in the exchange rate, indicating significant currency depreciation. To mitigate currency depreciation, the research advocates for policies promoting local renewable energy use to reduce import dependency and stabilize the currency. This approach includes investments in renewable infrastructure, community education, and economic diversification. This study highlights the need for further research into renewable energy's impact on exchange rates in Somalia, particularly in different economic contexts, to gain a more holistic understanding of these dynamics.

Keywords: Renewable Energy, Economic growth, Inflation rate, Exchange rate, Somalia
JEL Classifications: P28, Q56, E310, F310

1. INTRODUCTION

Energy is indispensable for fulfilling human needs and propelling economies forward. Nevertheless, to guarantee the achievement of long-term and environmentally friendly progress, governments must give utmost importance to enhancing energy efficiency and security. Acknowledging the significant influence of climate change, governments are becoming aware of the necessity to alter their energy strategies (Iqbal and Tabish, 2012; Shafie et al., 2011; Zhao et al., 2020; Zuo et al., 2020). The Sustainable Development Goals progress report for 2021 highlights the importance of energy in achieving sustainable development. It focuses on providing everyone with access to affordable, dependable, and up-to-date energy services while promoting the global adoption of renewable energy sources and enhancing energy efficiency (SDG7, 2021). This analysis highlights the energy security problems connected with reliance on fossil fuels.

The SDG7 2021 report states that to achieve the goals of SDG 7, an annual investment of $442 billion to 650 billion is needed for renewable energy projects. In addition, $560 billion will be needed for energy efficiency improvements, and $52 billion will be needed for inclusive electrification. These figures highlight the growing importance of renewable energy as a significant policy tool in the global energy transition. The global GDP is projected to grow at an average of 3.6% annually until 2040, with developed and developing countries contributing 2.1% and 4.7% annually, respectively. In 2010, developing countries consumed 16% more energy than developed countries and are projected to consume 88% more by 2040. the global CO_2

emissions are projected to increase from 31.2 to 45.5 billion metric tons (IEO, 2013).

In 2010, developing countries accounted for 38% more energy-related CO_2 emissions than developed countries and are predicted to have a 127% increase by 2040. Clean energy consumption is seen as a solution to reduce CO2 emissions. In 2014, China, the U.S., Japan, Germany, and the U.K. were the top investors in clean energy projects, accounting for 68.7% of global investments. China and India are the top and seventh countries in global clean energy investments, as reported by (BNEF, 2015).

Most Somalis still use inefficient energy sources such as imported diesel-powered generators, firewood, and charcoal to meet their daily energy demands. The number of people with access to power is relatively low,(Mohamud and Mohamud, 2023). Nevertheless, the United Nations in Somalia is spearheading innovative strategies to tackle energy and climate security concerns, which can bolster the country's peace and development objectives. Somalia has significant potential for renewable energy sources such as solar, wind, biomass, geothermal, and wave energy. The Juba and Shebelle rivers also have potential for hydropower generation, although their current utilization could be more efficient. With reasonable financial investment and existing technologies, wind, biomass, and solar-based renewable energy sources can be effectively harnessed in Somalia for domestic and industrial purposes (Habbane and McVeigh, 1985).

Nuñez (2015) report emphasizes renewable energy as a viable approach to tackling energy-related challenges in Somalia. Somalia possesses abundant wind and solar energy resources, boasting the most significant potential for onshore wind power in Africa and one of the highest rates of daily total solar radiation worldwide. Renewable energy products have become cost-competitive with fossil fuel alternatives due to declining costs. The wind farms at Oog and Aynabo demonstrate the significant impact that renewable energy may have on Somali cities. It can assist multiple sectors, including manufacturing, agriculture, and the fishing industry by offering essential refrigeration and lighting capabilities. Various problems, such as unfamiliarity, lack of energy awareness, high setting-up prices, and inadequate infrastructure, constrain Somalia's solar energy consumption. Nevertheless, the Somali government has implemented measures to tackle this problem by creating the National Regulatory Authority and aiming to raise energy accessibility from 15 to 45 as part of the 9th National Development Plan (2020–2024).

The study by Samatar et al. (2023) explores solar energy potential in Somalia, revealing its strong potential due to its location and large-scale power development. However, technical challenges like dust and heat limit panel performance, necessitating mitigation measures and investment in high-quality panels. Using diesel generators in Mogadishu, Somalia, has led to environmental pollution and climate change. This has prompted the exploration of renewable and alternative power-generating systems. A study suggests that a standalone wind-diesel-battery storage Hybrid Renewable Energy System (HRES) with specific components can be an optimal solution. The system includes a 1000 kW wind turbine, 350 kW diesel generator, 250 kW power converters, and 300 batteries. The net present cost of this system is estimated to be $5,056,700, and its energy cost is 0.191 $/kWh, which is cheaper than the conventional system (Dursun et al., 2021).

The study addresses the need for more consensus on the impact of renewable energy and the exchange rate in Somalia. It seeks to contribute to the knowledge on energy and exchange rate analysis in Somalia, which needs to be more consistent and limited. The study uses Cholesky's approach to estimate the variance decomposition and evaluate the impact of random innovations on energy usage, inflation, economic growth, and exchange rate. It employs reliable estimation techniques such as ARDL, FMOLS, and the Granger causality test to provide comprehensive recommendations for Somalia's exchange rate values. The paper is organized into sections that cover an overview of relevant literature, research methods and data, study findings, and policy implications.

2. LITERATURE REVIEW

Achieving economic growth and the Millennium Development Goals depend on a country's energy development. In developing nations like Somalia, energy shortages are significantly linked to poverty indices, including low literacy rates, short life expectancy, high infant mortality rates, low fertility rates, and fast urbanization (Lipton and Ravallion, 1995). Because of the country's meager energy resources, Somalia's urban population is expanding at an alarming rate. Most of the country's energy comes from wood and charcoal, which consume 80-90% of the total (African Development Bank, 2015). The literature extensively documents the impact of renewable energy, inflation rate, and economic growth on exchange rate values in Somalia.

Table 1 presents an in-depth summary of the literature examined in the study, together with the relevant econometric technique employed, the data analysis timeframe, and their research findings.

3. METHODOLOGY

The study examines the causal nexus between energy consumption, inflation, economic growth, and the exchange rate in Somalia. A time series of data from 1990 to 2019 was employed from the World Bank, SESRIC, and World Data.

The study employs the Autoregressive Distributed Lag (ARDL) model, favored for its efficacy in time series analysis over alternatives like Johansen co-integration and other models. The ARDL model is particularly adept at handling small sample sizes without compromising the accuracy and validity of coefficient estimates. In contrast to Johansen co-integration models, which necessitate two separate models to dissect short- and long-term effects, the ARDL model efficiently accomplishes this within a singular equation framework. A significant advantage of the ARDL model, as highlighted by Pesaran et al. (2001), is its capacity to incorporate variables irrespective of whether they are integrated of order zero, I(0), or order one, I(1). This capability renders it exceptionally apt for examining the interplay between dependent

Table 1: Summary of literature review

References	Period	Econometric approach	DV	IV	Finding
Peng et al., (2022)	1987-2020	ARDL, QARDL, NARDL, GCQ,	ED	Er, EC, PR	ΔERt →ΔEDt, ΔECt → ΔEDt, ΔEDt →ΔERt, ΔEDt →ΔECt
(Chen et al., 2020)	1995-2015	Panel cointegration tests, h linear GMM and threshold estimation methods			ΔLnRECit→Yit, Kit→Yit, Lit→Yit
(Deka et al., 2023)	1990-2019	ARDL	ER	EG, RE, INF, BOP, RIR	BOP→ER, EG→ER, RIR→ER, RE→ER, INF→ER
(Kilicarslan, 2018)	1974-2016	GARCH model, FMOLS	ER	LFDIt, LGFCFt, LTRADEt, LGGFCEt, LMONEYt	LGFCFt→ER, LMONEYt→ER, LTRADEt→ER, LFDIt→ER LGDPC→ER LGGEXP→ER
(Deka et al., 2023)	1990-2019	FMOLS and DOLS	ER	RE, INF, BOP, MS, GDP, PP, TRD	INFL→ER, POP→ER, GDP→ER, RE→ER, TRD→ER, exchange rate does not have any significant association with BOP and MS.
(Deka and Dube, 2021)	1990-2019	ARDL	ER	RE, INF	ER↔INF, RE→ER,
(Deka et al., 2022)	1990-2019	ARDL	ER	RE, INF	ER↔RE, RE→INF, ER→INF
(Ibrahim and Nageye, 2017)	1970-2014	OLS, MRA	ER	INF, EXD, MS, BOT, GDP, LG	TOB, MS and EXD has –VE significant relationship EX. LG has A+VE relationship to ER
(Warsame et al., 2023)	1970-2010	ARDL	INF	GDP, MS, EX	MS→INF, GDP→INF EX→INF, MS→EX GDP→ER
(Nor et al., 2020)	1995-2012	EGARCH Model	ER	DP, MS, HT	DP, MS, and HM have significant influence on Somali ER.
(Deka and Cavusoglu, 2022)	2000-2019	GMM, Bayesian VAR model	ER	IR, BOP, TO, RE, GD, INF	Long-term IR, RE, TO and BOP significantly encourage ER appreciation. GD and INF cause ER depreciation

and independent variables. Additionally, the model's flexible lag structure, guided by the general-to-specific modeling approach, accurately captures the data-generating process. This flexibility facilitates adjustments in the ARDL model parameters to reduce issues like indigeneity and serial correlation in the residuals, a point emphasized by (Pesaran and Shin, 1999). In this research, the exchange rate is the focal dependent variable, with economic growth, renewable energy consumption, and inflation rate as the independent variables. The ARDL model is utilized to probe into both the long-term and short-term relationships affecting the exchange rate.

A linear representation of the relationship between energy consumption, inf, and ex in Somalia is shown in Eq. (1):

$$InER_t = \beta_0 + \beta_1 InER_t + \beta_2 InRE_t + \beta_3 INF_t + \beta_4 InEG_t + \mu_t \quad (1)$$

ER is exchange rate, RE is renewable energy, INF is inflation rate and EG is economic growth, and μ_t is the error term. We turned all variables into natural logarithms. To evaluate the model's long-term association, equation (2) is rewritten in ARDL form.

$$\Delta InER_t = \alpha_0 + \beta_1 InER_{t-1} + \beta_2 InRE_{t-1} + \beta_3 InINF_{t-1} + \beta_4 InEG_{t-1} + \sum_{i=0}^{q} \Delta\alpha_1 InER_{t-k} + \sum_{i=0}^{p} \Delta\alpha_2 InRE_{t-k} + \sum_{i=0}^{p} \Delta\alpha_3 InINF_{t-k} + \sum_{i=0}^{p} \Delta\alpha_4 InEG_{t-k} + \varepsilon_{t-k} \quad (2)$$

Where α_0 is the constant, α_1 - α_7 are the short-run coefficients of variables, β_1 - β_7 are the elasticities of the long run of parameters, q expresses the explained optimal lags, p illustrates the optimal lags of the explanatory, Δ is the sign of first difference showing short run variables and ε_t is the error term. The ARDL co-integration approach undertake with bound testing.

The null hypothesis (H_0): $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$ propose that in the long-run variables are not co-integrated while the alternative hypothesis (H_1): $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$ argue that in the long-run variables are co-integrated. The Critical values and Wald-F statistics were employed to assess the null hypothesis. If the Wald-F statistics exceed the upper bound critical values, the null hypothesis is rejected, indicating that the variables are linked in the long run and vice versa.

4. RESULTS AND DISCUSSION

4.1. Descriptive Analysis and Correlation Matrix

The descriptive statistical analysis includes measures such as standard deviation, skewness, and an assessment of normality to provide context to the numerical data. The analysis reveals that the average foreign exchange rate is 19.12%, with a variation (standard deviation) of 1.62%. Economic growth, on the other hand, has an average value of 21.90% and a much lower standard deviation of 0.50%. The annual increase in inflation averages at 4.21, accompanied by a standard deviation of 0.69, while the average use of renewable energy stands at 1.97 with a standard deviation of 0.08. All the variables demonstrate a negative skewness, with the exchange rate (ER) exhibiting the highest standard deviation at 1.62, suggesting a considerable spread from its mean value. Additionally, a correlation analysis of the variables, as presented in Table 3, indicates that there is a positive correlation between economic growth, inflation, and energy consumption with the exchange rates in Somalia.

4.2. Unit Root Test

To accurately assess the time series characteristics of the variables under study, it is crucial to employ tests such as the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, which are instrumental in circumventing spurious results. The outcomes of these tests reveal that among the variables, only the inflation rate is stationary at level, denoted as I(0). In contrast, variables such as renewable energy, foreign exchange rate, and economic growth did not exhibit stationarity at their initial levels. However, stationarity was attained for these variables after applying the first difference, a process essential for stabilizing their time series properties.

4.3. Co-integration test

The study conducts a bounds test to explore the possibility of long-term co-integration between environmental degradation and other regressors. The results, particularly the Wald F-statistics valued at 6.0685, surpass both the lower and upper critical bounds at a 10% significance level. This outcome suggests the presence of a long-term relationship among the variables. While short-term fluctuations or shocks are plausible, the findings indicate a likelihood of convergence over time.

4.4. ARDL Long-run and Short-run Results

In examining the interplay between renewable energy, inflation, economic growth, and the exchange rate in Somalia from 1990 to 2019, the long-run estimations derived from the Autoregressive Distributed Lag (ARDL) model provide insightful revelations.

Table 2: Descriptive statistics

Stats	InER	InRE	InINF	InEG
Mean	19.121	1.9686	4.2086	21.902
Median	19.639	1.9698	4.5099	21.925
Maximum	21.149	1.9818	4.8059	22.642
Minimum	15.966	1.9484	2.0605	21.146
Standard deviation	1.6237	0.0081	0.6945	0.4953
Skewness	−0.4658	−0.9063	−1.7964	−0.0024
Kurtosis	1.8785	3.2827	5.2671	1.6331
Jarque-Bera	2.6569	4.0668	22.506	2.3355
Probability	0.2648	0.1308	0.0000	0.3110

Source: Extract from E-views 12 students

Table 3: Correlation matrix

Variables	InER	InRE	InINF	InEG
InER	1	0.9366	0.8602	0.9544
InRE	0.9366	1	0.9243	0.8704
InINF	0.8602	0.9243	1	0.7266
InEG	0.9544	0.8704	0.7266	1

Source: Extract from E-views 12 students

Table 4: Unit root test

Variables	Augmented Dickey-Fuller (ADF)		Phillip- Perron (PP)	
	Level	Diff.	Level	Diff.
InER	−2.0807	−4.1960***	−3.9812***	−4.085***
InRE	−2.6392	−3.2951***	−2.6392	−3.2205***
InEG	−0.7279	−6.4792***	0.2774	−4.7968***
InINF	−11.855***	------------	−11.225***	-------------

Source: Extract from E-views 12 students and the significance levels are 10%, 5%, and 1%

Table 5: F bound test

Test statistic	Value	Significance	I (0)	I (1)
F-Statistic	6.0685		Asymptotic: n=1000	
K		10%	2.37	3.2
		5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

The constant term's coefficient, significant at the 1% level, indicates a robust baseline effect on the exchange rate. It sets a foundational value for the dependent variable, acting as the exchange rate's expected level in the absence of influences from the independent variables under study.

The influence of renewable energy (RE) on the exchange rate is particularly noteworthy. The coefficient is significant at the 10% level, implying there is a 90% confidence level in the positive relationship between renewable energy usage and the exchange rate. A 1% increase in renewable energy usage is associated with an 80% point increase in the exchange rate. This suggests that as Somalia invests in renewable energy, it could significantly depreciate its currency over time. This aligns with the findings of (Deka et al., 2023).

Inflation's relationship with the exchange rate is also pronounced and statistically significant at the 1% level, indicating a strong and reliable positive correlation. The model predicts that a 1% rise in the inflation rate correlates with a 2.02% increase in the exchange rate over the long term. This supports the hypothesis that higher inflation, potentially indicative of stronger domestic demand, can lead to a stronger currency. This finding is in line with the findings of (Deka and Dube, 2021).

The positive coefficient for economic growth (EG) further indicates that a 1% increase in economic growth corresponds to a 4.33% increase in the exchange rate in the long term. This positive correlation is corroborated by the literature, including studies by Deka et al. (2023), and Deka and Cavusoglu (2022), which found that economic growth fosters a favorable exchange rate environment.

Figure 1: CUSUM test

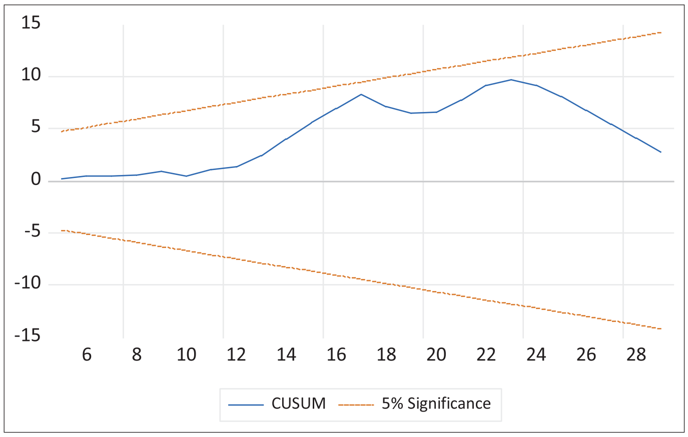

Figure 2: CUSUM square test

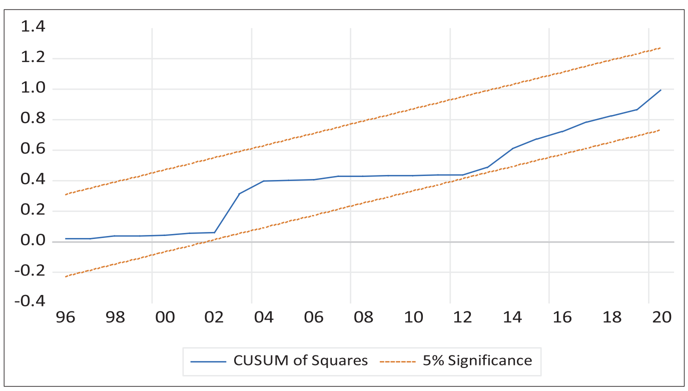

Table 6: Long-run results

Variables	Coefficient
C	4.4353
	(4.4579) ***
InRE	79.575
	(1.8167) *
InINF	2.0190
	(2.5533)***
InEG	4.3333
	(3.1976) ***
Reset test	1.2387 (0.2767)
Serial correlation	0.9465 (0.4133)
Heteroskedasticity	1.7390 (0.1612)
Normality	0.6922 (0.37074)

*, **,*** donate at 10%, 5%, and 1% significance levels

The robustness of the ARDL model's findings is supported by various diagnostic tests. The reset test indicates no model misspecification, while tests for serial correlation, heteroskedasticity, and normality of residuals all suggest that the model is well-specified with reliable error terms. Additionally, CUSUM and CUSUM-square tests indicate that the coefficients of the ARDL model are stable over the sample period, as shown in Figures 1 and 2.

The Table 6 presents the short-run dynamics of an ARDL model applied to the exchange rate in Somalia, focusing on the impacts of changes in economic growth, renewable energy consumption, and inflation. In the short run, changes in economic growth (ΔlnEG) have a highly significant positive effect on the exchange rate, as do changes in renewable energy consumption (ΔlnREC), both significant at the 1% level. This indicates that in the short-term,

Table 7: Short-run and error correction results

Variables	Coefficient
ΔInEG	4.3333
	(5.9506)***
ΔInREC	70.575
	(2.9110)***
ΔInINF	−0.4643
	(−0.7473)
ΔInINFt-1	−2.3244
	(−3.4944) ***
ΔInINFt-2	−2.0190
	(−3.2431) ***
ECT_{t-1}	−1.1970
	(−5.4310) ***

Table 8: FMOLS Method

Variables	Coefficient
C	−42.975
	(0.0023)***
InRE	2.8817
	(0.4817)
InEG	2.4376
	(10.359)***
InINF	0.7278
	(3.4972)***

Table 9: Granger causality tests

Null hypothesis	Obs	F-stat	Prob
InEG→InER	28	0.7792	0.4705
InER→InEG	28	11.597	0.0003
InRE→InER	28	0.6245	0.5447
InER→InRE	28	2.1890	0.1358
InINF→InER	28	0.6650	0.5239
InER→InINF	28	2.0544	0.1510
InRE→InEG	28	10.938	0.0005
InEG→InRE	28	1.7405	0.1987
InINF→InEG	28	11.032	0.0004
InEG→InINF	28	0.2677	0.7675
InINF→InRE	28	1.2374	0.3095
InRE→InINF	28	0.2746	0.7624

→ signifies that variable "X" does not granger cause variable "Y increases in both economic growth and renewable energy consumption are associated with an increase in the exchange rate. However, the immediate effect of inflation (ΔlnIF) is statistically significant, suggesting that within the same period, inflation has a negative impact on the exchange rate.

The significance of past inflation rates is revealed with one and two-period lags (ΔlnIFt-1 and ΔlnIFt-2), both showing a significant negative effect on the exchange rate at the 1% level, indicating that past inflation has a detrimental effect on the exchange rate. The error correction term (ECT_t-1) is negative and statistically significant, which is typical for an error correction model and indicates that any short-term disequilibrium in the exchange rate is corrected relatively quickly, at a rate of approximately −1.1970 per period. This reflects the speed at which the exchange rate adjusts to maintain long-term equilibrium following any short-term shocks.

4.5. Robust Analysis

Table 8 presents an analysis using Fully Modified Ordinary Least Squares (FMOLS) to corroborate the long-run results obtained from the ARDL model shown in Table 6. This analysis confirms that increases in the inflation rate and economic growth significantly impact the exchange rate in Somalia. Conversely, the data indicates that the use of renewable energy does not exert any significant effect on the exchange rate. The findings suggest that for every 1% rise in economic growth and inflation rate, there is

Table 10: Variance decomposition

(a) Variance decomposition			**of InER**		
Period	**S.E.**	**INER**	**INEG**	**ININF**	**INRE**
1	0.222176	100	0.000000	0.000000	0.000000
2	0.301865	99.21727	0.163952	0.456028	0.162750
3	0.326015	97.06545	1.582421	0.421117	0.931013
4	0.336122	93.73176	3.467351	0.517094	2.283798
5	0.342794	91.14609	4.827966	0.799835	3.226107
6	0.347954	89.78565	5.565678	1.165226	3.483443
7	0.353271	89.03619	5.960631	1.589758	3.413426
8	0.358840	88.35673	6.248948	2.071988	3.322330
9	0.364081	87.46921	6.563275	2.624090	3.343425
10	0.368945	86.27781	6.933256	3.250148	3.538781
(b) Variance decomposition			**Of InEG**		
Period	**S.E.**	**lnER**	**lnEG**	**lnINF**	**lnRE**
1	0.048177	5.450251	94.54975	0.000000	0.000000
2	0.055150	4.218122	95.51752	0. 189465	0.074891
3	0.062343	8.990678	88.51151	0.882636	1.615178
4	0.070849	19.45702	75.15969	1.506934	3.876354
5	0.079595	27.31083	64.61143	2.146255	5.931488
6	0.086916	30.50906	58.75127	3.056633	7.683034
7	0.093177	30.97550	55.35866	4.239449	9.426386
8	0.099040	30.24345	52.75723	5.559689	11.43963
9	0.104976	29.04986	50.21468	6.874333	13.86112
10	0.111209	27.65427	47.59159	8.088083	16.66605
(c) Variance decomposition			**Of InINF**		
Period	**S.E.**	**lnER**	**lnEG**	**lnINF**	**lnRE**
1	0.053010	0.212686	2.518123	97.26919	0.000000
2	0.073908	15.74165	1.567115	82.56876	0.122478
3	0.083426	16.59534	1.236941	78.86610	3.301616
4	0.092788	13.61580	1.230120	75.68777	9.466313
5	0. 103128	11.02434	1.511623	71.02915	16.43489
6	0.114040	9.032769	1.918944	65.10997	23.93831
7	0.125620	7.463785	2.396322	58.77889	31.36101
8	0.137674	6.228542	2.946510	52.81886	38.00608
9	0.149928	5.263342	3.566178	47.54841	43.62207
10	0.162212	4.506198	4.236445	43.00938	48.24798
(d) Variance decomposition			**Of InRE**		
Period	**S.E.**	**lnER**	**lnEG**	**lnINF**	**lnRE**
1	0.001330	2.291837	0.132910	1.557809	96.01744
2	0.002069	11.96925	0.334052	10.20808	77.48862
3	0.002529	15.49821	1.771094	11.60206	71.12863
4	0.002840	12.96174	4.211082	12.24101	70.58618
5	0.003138	10.64671	6.579625	13.01370	69.75997
6	0.003432	8.937163	8.165389	13.55013	69.34732
7	0.003724	7.595196	9.116681	13.67151	69.61661
8	0.004019	6.606710	9.760845	13.53733	70.09512
9	0.004313	5.868993	10.32658	13.31985	70.48457
10	0.004603	5.274858	10.89675	13.09991	70.72848

an expected increase in the exchange rate by 2.43% and 0.73%, respectively.

4.6. Causality Test

The Granger causality test, as depicted in Table 9, was utilized to ascertain the causal relationships among the variables. The test results reveal a one-directional causality, linking the exchange rate to economic growth. Similarly, a unidirectional causality is observed from renewable energy consumption (REC) to economic growth, and from the inflation rate to economic growth.

4.7. Variance Decomposition

In this analysis, Cholesky's variance decomposition method is applied within the Vector Autoregression (VAR) framework to assess how different variables respond to unforeseen shocks in the system. The findings, as detailed in Table 10a, indicate that 6.93% of future variances in the natural logarithm of the exchange rate (lnER) can be attributed to shocks in the natural logarithm of economic growth (lnEG), while 3.25% and 3.54% of lnER's future variances are due to shocks in the natural logarithm of inflation (lnINF) and renewable energy (lnRE), respectively. This suggests that for Somalia, economic growth is likely to have a more pronounced impact on the exchange rate in the future compared to renewable energy and inflation.

Further insights from Table 10b reveal that 27.65% of the future variances in lnEG are the result of shocks in lnER, with 8.09% and 16.67% arising from lnINF and lnRE, respectively. This implies that exchange rates will have a more substantial effect on Somalia's economic growth in the future compared to renewables and inflation. Additionally, Table 10c shows that 48.25% of the future variances in lnINF are due to shocks in lnRE, while 4.51% and 4.24% are attributable to shocks in lnER and lnEG, respectively. This indicates that renewable energy is expected to be a more significant determinant of future inflation in Somalia than the exchange rate and economic growth. Lastly, as per Table 10d, 13.01% of the future variances in lnRE can be traced back to shocks in lnINF, with lnEG and lnER contributing 10.90% and 5.28%, respectively. Thus, for Somalia, inflation is predicted to influence renewable energy utilization in the future more than economic growth and exchange rates.

5. CONCLUSION AND POLICY IMPLICATIONS

This research employs an Autoregressive Distributed Lag (ARDL) model to analyze the influence of renewable energy consumption (REC), economic growth, and inflation rate on the exchange rate fluctuations in Somalia over the period from 1990 to 2019. The study uncovers a unidirectional causal relationship linking economic growth with the exchange rate, REC, and the inflation rate. Statistical analysis indicates that economic growth and REC significantly affect the exchange rate positively in both the short and long run, whereas inflation exhibits a negative effect in the short run, suggesting short-term currency appreciation with higher inflation rates. Contrarily, in the long run, higher inflation rates contribute to currency depreciation, in line with Fisher's (1930) Relative Purchasing Power Parity theory.

A noteworthy finding is the substantial positive impact of renewable energy on Somalia's foreign exchange rate in the long run. Specifically, a 1% increase in REC correlates with an 80 percentage point rise in the exchange rate, signifying that enhanced renewable energy usage leads to currency depreciation. This result is statistically significant at the 10% level. The study's results align partially with Deka et al. (2021), supporting the notion that renewable energy consumption influences currency depreciation. The findings enrich the literature by providing empirical evidence of the effects of renewable energy, economic growth, and inflation on exchange rate dynamics in the Somali context.

To address currency depreciation, the study suggests policies focusing on promoting local renewable energy usage to decrease import dependency and stabilize the currency. This involves investments in renewable infrastructure, community education, economic diversification, and improved financial policies. Additionally, fostering international partnerships and a supportive regulatory environment for renewable energy is crucial for sustainable development and financial stability in Somalia.

However, the research's limitation lies in its focus on a limited set of variables, potentially overlooking other determinants of exchange rate fluctuations. This calls for further exploration into the role of renewable energy in exchange rate dynamics, considering the variance in impact based on a nation's import-export status. Future research should broaden its perspective to include diverse economic contexts for a more comprehensive understanding of these dynamics.

6. FUNDING

Grateful acknowledgment to SIMAD University for their generous support in funding this research paper.

REFERENCES

African Development Bank. (2015), Somalia Energy Sector Needs Assessment and Investment Programme. Abidjan. Available from: https://www.afdb.org

Bloomberg Energy Finance. (2015), Global Trends in Renewable Energy Investment, Report. Frankfurt School-UNEP Centre.

Chen, C., Pinar, M., Stengos, T. (2020), Renewable energy consumption and economic growth nexus: Evidence from a threshold model. Energy Policy, 139, 111295.

Deka, A., Cavusoglu, B. (2022), Examining the role of renewable energy on the foreign exchange rate of the OECD economies with dynamic panel GMM and Bayesian VAR model. SN Business and Economics, 2(9), 119.

Deka, A., Cavusoglu, B., Dube, S. (2022), Does renewable energy use enhance exchange rate appreciation and stable rate of inflation? Environmental Science and Pollution Research, 29(10), 14185-14194.

Deka, A., Cavusoglu, B., Dube, S., Rukani, S., Kadir, M.O. (2023), Examining the effect of renewable energy on exchange rate in the emerging economies with dynamic ARDL bounds test approach. Renewable Energy Focus, 44, 237-243.

Deka, A., Dube, S. (2021), Analyzing the causal relationship between exchange rate, renewable energy and inflation of Mexico (1990-2019) with ARDL bounds test approach. Renewable Energy Focus, 37, 78-83.

Deka, A., Ozdeser, H., Cavusoglu, B., Seraj, M., Tursoy, T. (2023), Exchange rate stability in the emerging economies: Does renewable energy play a role-a panel data analysis. Environmental Science and Pollution Research, 30(9), 23668-23677.

Dursun, S., Aykut, E., Dursun, B. (2021), Assessment of optimum renewable energy system for the Somalia-Turkish training and research hospital in Mogadishu. Journal of Renewable Energy and Environment, 8, 54-67.

Fisher, I. (1930). The Theory of Interest, as Determined by Impatience to Spend Income and Opportunity to Invest It. Macmillan, New York.

Energy Information Administration. (2013), International Energy Outlook. United States: Energy Information Administration.

Habbane, A.Y., McVeigh, J.C. (1985), An energy policy for Somalia. Solar and Wind Technology, 2(1), 53-58.

Ibrahim, M.I., Nageye, A.I. (2017), Determinants of exchange rates in Somalia. Asian Journal of Economic Modelling, 5(3), 233-244.

Iqbal, K.M.J., Tabish, M.I. (2012), Energy Policy in SOUTH ASIA: The Way Forward to Prompt Regional Trade. Islamabad, Pakistan: SAARC Chamber of Commerce and Industry.

Kilicarslan, Z. (2018), Determinants of exchange rate volatility: Empirical evidence for Turkey. Pressacademia, 5(2), 204-213.

Lipton, M., Ravallion, M. (1995), Poverty and policy. In: Handbook of Development Economics. Vol. 3. Netherlands: Elsevier Science. p2551-2657.

Mohamud, I.H., Mohamud, A.A. (2023), The impact of renewable energy consumption and economic growth on environmental degradation in Somalia. International Journal of Energy Economics and Policy, 13(5), 533-543.

Nor, M. I., Masron, T. A., & Alabdullah, T. T. Y. (2020). Macroeconomic Fundamentals and the Exchange Rate Volatility: Empirical Evidence From Somalia. SAGE Open, 10(1). https://doi.org/10.1177/2158244019898841

Nuñez, J.N. (2015), Powering Progress: The Potential of Renewable Energy. Somalia: Shuraako.

Peng, B., Chang, B.H., Yang, L., Zhu, C. (2022), Exchange rate and energy demand in G7 countries: Fresh insights from Quantile ARDL model. Energy Strategy Reviews, 44, 100986.

Pesaran, M., Shin, Y. (1999), An autoregressive distributed lag modeling approach to cointegration analysis. In: Strom, S., editors. Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch centennial Symposium. Cambridge: Cambridge University Press.

Pesaran, M., Shin, Y., Smith, R. (2001), Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16, 289-326.

Samatar, A.M., Mekhilef, S., Mokhlis, H., Kermadi, M., Diblawe, A.M., Stojcevski, A., Seyedmahmoudian, M. (2023), The utilization and potential of solar energy in Somalia: Current state and prospects. Energy Strategy Reviews, 48, 101108.

SDG7. (2021), The Sustainable Development Goals Report 2021. Ensure Access to Affordable, Reliable, Sustainable and Modern Energy for All The Lights are Going Out in Parts of Africa and Asia Due to the Effects of Growing Poverty. New York: United Nations Publications. p40-41.

Shafie, S.M., Mahlia, T.M.I., Masjuki, H.H., Andriyana, A. (2011), Current energy usage and sustainable energy in Malaysia: A review. Renewable and Sustainable Energy Reviews, 15(9), 4370-4377.

Warsame, Z.A., Hassan, A.M., Hassan, A.Y. (2023), Determinants of inflation in Somalia: An ARDL approach. International Journal of Sustainable Development and Planning, 18(9), 2811-2817.

Zhao, X., Gu, B., Gao, F., Chen, S. (2020), Matching model of energy supply and demand of the integrated energy system in coastal areas. Journal of Coastal Research, 103, 983-989.

Zuo, X., Dong, M., Gao, F., Tian, S. (2020), The modeling of the electric heating and cooling system of the integrated energy system in the coastal area. Journal of Coastal Research, 103, 1022-1029.