Warsame, Abdimalik Ali

Article

The impact of urbanization on energy demand : an empirical evidence from Somalia

International Journal of Energy Economics and Policy

Reference: Warsame, Abdimalik Ali (2022). The impact of urbanization on energy demand : an empirical evidence from Somalia. In: International Journal of Energy Economics and Policy 12 (1), S. 383 - 389.
https://econjournals.com/index.php/ijeep/article/download/11823/6623.
doi:10.32479/ijeep.11823.

IJEEP
INTERNATIONAL JOURNAL OF ENERGY ECONOMICS AND POLICY
EJ EconJournals
ISSN: 2146-4553

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2022, 12(1), 383-389.

EJ EconJournals

The Impact of Urbanization on Energy Demand: An Empirical Evidence from Somalia

Abdimalik Ali Warsame[1,2]*

[1]Faculty of Economics, SIMAD University, Mogadishu, Somalia, [2]Garaad Institute for Social Research and Development Studies, Mogadishu, Somalia. *Email: abdimalikali1995@gmail.com

Received: 17 August 2021 **Accepted:** 21 December 2021 **DOI:** https://doi.org/10.32479/ijeep.11823

ABSTRACT

Somalia is recovering from a long-period of civil unrest and political instability. The urbanized population are growing at unprecedented rate, and there is an energy supply shortage. little is understood the nexus between urbanization and energy consumption in the context of Somalia. To this end, this study assesses the effect of urbanization on energy demand in Somalia while controlling the effects of economic growth and population growth. To achieve the aim, the study employs fully modified ordinary least square (FMOLS), canonical cointegration regression (CCR) and impulse response function (IRF) with time series data spanning from 1990 to 2018. Before the long-run model estimation, Augmented Dickey-Fuller (ADF) and Philips's Perron (PP) tests – used for unit root test – demonstrated that all the variables are stationary at the first difference I (1). The empirical results indicate that urbanization impedes energy consumption, whereas economic growth and population growth increase energy demand in the long-run. Besides, the result of IRF demonstrate that one standard deviation shock in urbanization (lnUB) results in energy consumption to decrease (lnEC) in the whole 10 periods. This calls for the Somali policy makers to consider urbanization as an effective determinant while targeting energy conservation policy in order to mitigate the fossil fuel energy use.

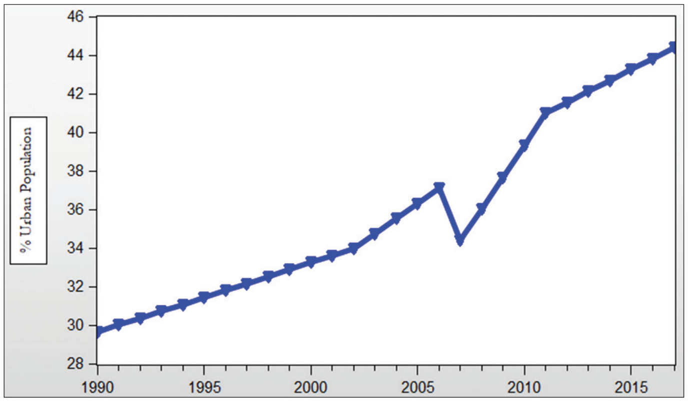
Keywords: Energy Demand, Urbanization, FMOLS, IRF, Somalia
JEL Classifications: Q41, Q43, Q48

1. INTRODUCTION

Urbanization is an issue of social and economic modernization. It does not only imply the transformation of rural labor from agriculture-based economy to industrial and service sector economy in urban areas, but it also involves the structural change of rural areas into urban areas. However, these processes lead to rapid growth in fossil fuel energy demand which releases carbon dioxide emissions into the atmosphere (Nguyen and Ngo, 2019). Nevertheless, the nexus between urbanization-energy-environment issues have been studying extensively in the literature in recent decades including, inter alia, energy consumption and urbanization; environmental pollution and urbanization. (Poumanyvong and Kaneko, 2010; Sbia et al., 2017; Shahbaz et al., 2017).

Somalia is considered one of the fastest urbanizing countries in Africa. Its current urban population is estimated at 6.45 million people which makes up 45% of the total population. And it is growing a substantial annual average rate of 4.2%. The UN Department of Economic and Social Affairs predicted that Somalia urban population will overtake the rural population in 2026 (Aubrey and Cardoso, 2019). The urbanization – which is measured for the urban population – shows an increasing trend in Somalia since in 1990, despite there were periodical reductions in some years, namely in 2006-2007 (Figure 1). But 2008 and onward, the urban population soared back substantially. The rapid urban population in Somalia is partly attributed to internal displacements that resulted from conflicts and droughts. But unfortunately, these internal displaced people are reported to live in vulnerable circumstances and require durable solutions.

Figure 1: Urban Population in Somalia.



Source: World Bank, (2021)

Energy insecurity is one of the hurdles currently confronting by the rapid growth of the urban population due to limited supply of energy in Somalia. Firewood and charcoal are the predominant energy consumption which represents 80% - 90% of the total energy consumption (Federal Government of Somalia, 2015; African Development Bank, 2015) Somali population who can access electricity is one of the lowest rates in East African countries. Only 36% of the total population have access to the electricity energy compared to 69.7% in Kenya and 48.3% in Ethiopia as of 2019. It is notable that electricity price in Somalia is one of the highest in the world (World Bank, 2021). Depending on traditional biomass energy does not cover energy demand sufficiently, rather than it erodes the ecosystem, depletes natural resources and degrades the environment (Warsame & Sarkodie, 2021). Hence, this ultimately induces climate change and hamper agriculture production (Warsame et al., 2021).

There is no a consensus reached about urbanization and energy consumption nexus in the existing literature. Some plausible explanations for this inconclusive result can be the data and methods used, and the impacts of urbanization on energy consumption at different levels of development. On one hand, urbanization enhances energy consumption through the linkages of urban infrastructure, energy usage within civil buildings, mobility and transportation needs, and industrial production (Madlener and Sunak, 2011; Liu et al., 2020). Accordingly, the extant literature revealed that urbanization increases electricity, energy and coal consumption in China (Lv et al., 2019; Yang et al., 2019). In the same vein, the positive impact of urbanization on energy consumption has been found in Middle East and North African (MENA) countries. But the positive result was only found in high income countries (Al-Mulali et al., 2013). Urbanization exerts an increase in energy demand through urban infrastructure. The impact of urbanization on energy demand is examined in China (Madlener and Sunak, 2011). It is reported that energy demand rises due to an increase in urbanization through an expansion in infrastructure. Utilizing a panel data of 78 countries, Sheng et al. (2017) reported that urbanization stimulates energy consumption. This result corroborates with several cross country studies (see; Mrabet et al., 2019). In a recent study conducted by Torasa et al. (2020) in Thailand – utilizing a time series data and an ARDL bound test – has found that urban sprawls exerts energy demand to increase (Torasa et al., 2020).

On the other hand, urbanization inhibits energy demand through economies of scale, shortened travel distances due to compact city layout and urban transportation system. Accordingly, several empirical studies uncovered the reducing impact of urbanization on energy demand (Sarkodie and Adom, 2018; Poumanyvong and Kaneko, 2010). Determinants of energy consumption in Kenya were modeled using the nonlinear iterative partial least squares (NIPALS) method. It is reported that urbanization reduces energy consumption due to economies of scale (Sarkodie and Adom, 2018). Some studies argue that the effect of urbanization on energy demand is dependent on the stage of development of a country or region. This implies that urbanization reduces energy demand in low-income countries and stimulates it in high income nations. A cross country analysis that divided the sample countries into low-income and high-income countries reported that urbanization reduces energy demand in low-income countries (Poumanyvong and Kaneko, 2010). Likewise, Li and Lin (2015) reveals that urbanization undermines energy consumption in low-income countries but rises it in high-income countries.

According to the literature reviewed above, the nexus between urbanization and energy consumption has shown inconsistent results. Even though the relationship between these two variables was extensively investigated in developed and developing countries, but in the context of less developed countries, including Somalia, there are limited studies. Furthermore, Unplanned and rapid urbanization may entrench the dynamics of clan and conflicts in Somalia resulting from the evolution of cities in Somalia (Aubrey and Cardoso, 2019). Considering the unprecedented growth of urban population, severe energy shortages and significant environmental degradation that Somalia is currently encountering, there is a dire need to address the role of urbanization in energy demand in Somalia. Nevertheless, this study contributes to the literature in several ways. First, the urbanization-energy demand nexus has been studied extensively in the literature, but no study has been considered in the context of Somalia. Hence, to bridge that gap this study examines the role of urbanization in energy consumption in Somalia using fully modified ordinary least square (FMOLS) and canonical cointegration regression. Second, the study also considers the response of energy demand to shock effects in urbanization by utilizing the impulse response function (IRF). To achieve the aim, the study utilizes time series data spanning 1990 to 2018.

The rest of the study is structured as follows; material and methods are presented in chapter two, chapter three reports empirical result and analysis and finally, chapter four concludes the study and suggests policy recommendations.

2. MATERIALS AND METHODS

2.1. Data Sources

To achieve the objective of the study, we utilize time series data extracted from world development indicators, the Organization of Islamic Cooperation (OIC) and our world data. The time-series data utilized spans 1990-2017. The variables include energy consumption, urbanization, economic growth and population growth. Measurements and sources of the variables are presented

Figure 2: Trends of the Sampled variables. (a) Population Growth (b) Energy Consumption (c) Economic Growth (d) Urbaization

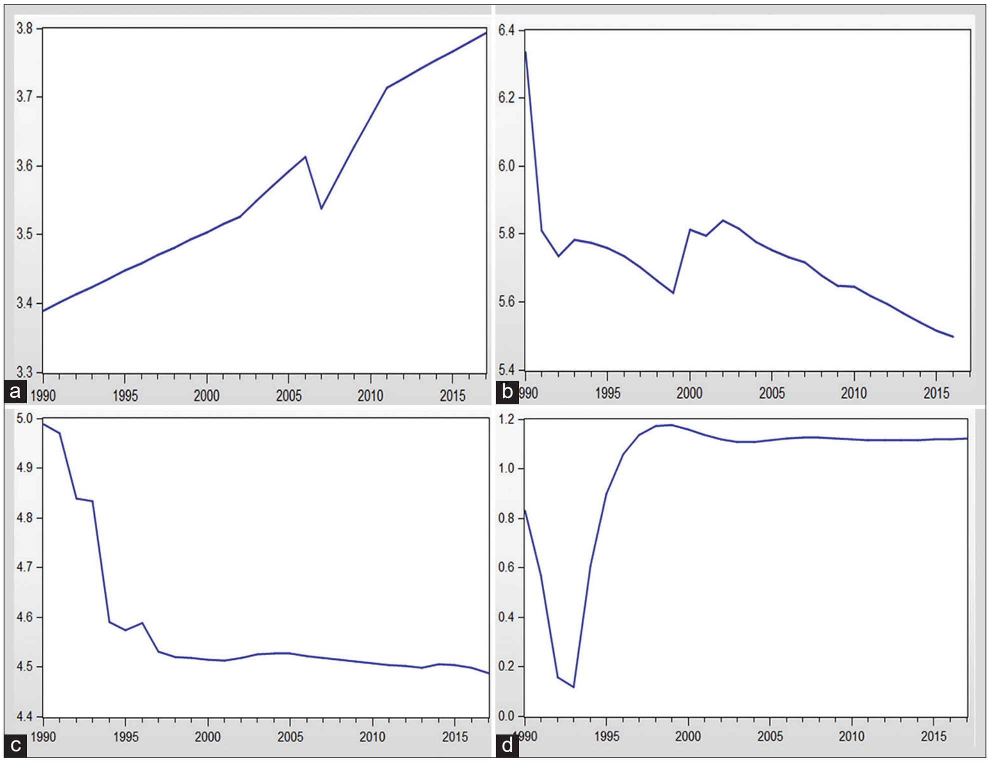


Table 1: Variable description and source

Variable	Code	Description	Source
Energy consumption	EC	Energy consumption per capita	World data
Urbanization	UB	Urban population	World Bank
Real growth domestic product per capita	RGDPC	RGDPC constant 2010	OIC database
Population growth	PG	Rate of population growth	OIC database

in Table 1. Moreover, the trend of the series is reported in Figure 2. Urbanization and population growth show an increasing trend, whereas economic growth and energy consumption exhibit a decreasing trend.

2.2. Econometric Methodology

This study examines energy consumption as a function of urbanization, economic growth and population growth in Somalia. The model of the study is formulated, by following the studies of (Sarkodie and Adom, 2018; Lv et al., 2019), as follows:

$$lnEC_t = \beta_0 + \beta_1 lnUB_t + \beta_2 lnEG_t + \beta_3 lnPG_t + \varepsilon_t \quad (1)$$

$lnEC_t$ is the natural logarithm of energy consumption, $lnUB_t$ is the natural logarithm of urbanization, $lnEGt$ the is natural logarithm of economic growth, $lnPG$ is the natural logarithm of population growth and ε_t is the disturbance term. All the series were converted into natural logarithm, to avoid heteroskedasticity problem, model mis-specification functional form and non-normality.

The objective of this study is to investigate the long-run effects of urbanization, economic growth and population growth on energy consumption in Somalia, hence, we utilize Fully Modified Ordinary Least Square (Phillips and Hansen, 1990) and Canonical Cointegration regression (Park, 1992). Some of the limitations in time series data include endogeneity problem and serial correlation, however, fully modified ordinary least square and canonical cointegration regression are robust for these issues. It implies that they address the serial correlation and endogeneity problem that arises from the cointegration results. These two methods are asymptotical equivalent. One of the strengths of Fully modified ordinary least square is that its ability to eradicate the second-order bias issues (Phillips and Hansen, 1990). It is also robust for series containing a unit root problem or not and produces a consistent and efficient results even in the absence of level relations. However, to model the parameters' long-run coefficient elasticities by employing fully modified ordinary least square; y_t - the regressand – and X_t (is a vector of explanatory variables where X_t is an M X 1 vector and T= 1,2,3,….,N) should satisfy the following condition:

$$Y_t = X_t'\beta + d_t'\alpha + \mu_{1t} \quad (2)$$

$$X_t = X_{t-1} + \mu_{2t} \quad (3)$$

Where dt is a vector of deterministic trend regressors; $\mu t = (\mu_{1t}, \mu_{2t}')'$ are the error terms. Following this, Λ and Ω, which are the long-run covariance matrix, can be estimated by using the following two equations.

$$\sum_{i=0}^{\infty} E(\mu_t \mu_{t-1}') = \begin{vmatrix} \lambda_{11} & \lambda_{12} \\ \lambda_{21} & \Omega_{22} \end{vmatrix} \quad (4)$$

$$\Omega = \sum_{i=-\infty}^{\infty} E(\mu_t \mu_{t-1}^{'}) = \begin{vmatrix} \Phi_{11} & \Phi_{12} \\ \Phi_{21} & \Lambda_{22} \end{vmatrix} \tag{5}$$

Subsequently, suppose $Y_t^{+} = Y_t - \Phi_{12}\Omega_{22}^{-1}\Delta X_t$; $\lambda_{12}^{+} = \lambda_{12} - \Phi_{12}\Lambda_{22}\Delta X_t$, where λ_{12}, Φ_{12}, Ω_{22}^{-1} and Λ_{22} are estimated parameters.

Fully modified ordinary least square employs the transformation of data and estimation transformation. If we let (y_t, x_t) be $n+1$ dimensional process I (1). Then, the cointegration system can be formulated in triangular form as follows:

$$Y_t = X_t'\beta + d_t'\gamma + \mu_{1t} \tag{6}$$

$$\Delta y_{2t} = \varepsilon_{2t} \tag{7}$$

ε_t represent μ_{1t}, ε_{2t} which are assumed that they are stationary accompanied with zero mean and infinite covariance matrix $\sum$ and $\sum$ is not block diagonal.

3. EMPIRICAL RESULTS AND ANALYSIS

3.1. Descriptive Statistics

The summary statistics, presented in Table 2, reveals that energy consumption has a mean value of 5.7; economic growth, 4.5; population growth, 0.99; and urbanization, 3.5. Energy consumption has the highest maximum value, whereas population growth has the lowest minimum value. Furthermore, all the interesting parameters are positively skewed, while population growth is negatively skewed. In contrast, Table 2 also reports the correlation of the interested variables. Energy consumption is negatively correlated with population growth and urbanization. But it has a positive association with economic growth. Economic growth is negatively correlated with population growth and urbanization. On the contrary, population growth and urbanization are positively correlated.

3.2. Unit Root

Time series data often displays a trending persistence which results in the violation of the moment of condition. As a pre-requisite step in time series data, it should be checked for persistence. This study utilized augmented dickey-fuller (ADF) and Philip Perron (PP) tests to detect the presence of unit root problem. Hence, the result reported in Table 3 indicates that most of the series in level exhibit a unit root problem. Nevertheless, at first difference I (1), all the series did not exhibit any unit root. It implies that the series are stationary at the first difference I(1). Hence, we can proceed to estimate the long-run cointegration of the study.

To assess the presence of a common deterministic trend in the variables, we use Johansen multivariate cointegration test. Table 4 presents the result of the Johansen cointegration test. Trace test indicates that there are at least two cointegrating equations. This is also verified by the maximum-Eigen value which shows the existence of two cointegrating vectors. Therefore, the interested parameters move together in the long-run. This implies that there is a common deterministic trend in these series. Thus, economic growth, urbanization and population growth can be considered as the long-run forcing variables for energy consumption in Somalia.

Table 2: Descriptive statistics

	lnEC	lnEG	lnPG	lnUB
Mean	5.720889	4.580071	0.992356	3.562565
Median	5.732026	4.518522	1.117071	3.538173
Maximum	6.334368	4.988526	1.177336	3.779999
Minimum	5.496287	4.498364	0.117356	3.389732
Std. Dev.	0.156198	0.144161	0.291145	0.122808
Skewness	2.071193	2.030195	−2.123202	0.403549
Jarque-Bera	73.94418	25.93314	32.58924	2.074847
Probability	0.000000	0.000002	0.000000	0.354367
Correlation				
lnEC	1			
lnEG	0.6445	1		
lnPG	−0.2872	−0.7798	1	
lnUB	−0.6926	−0.6267	0.5392	1

Table 3: Unit root tests

Variable	ADF		PP	
	Level	First difference	Level	First difference
lnEC	−7.0145**	−9.9176***	−5.7692***	−9.9176***
lnEG	−25.4733***	−6.2791***	−3.0029	−6.1671***
lnPG	−5.8071***	−6.1932***	−2.0597	−3.2030
lnUB	−2.2708	−5.1483***	−2.2706	−5.2270***

***, ** and * indicate significance level at 10%, 5% and 1% respectively. The t-statistics reported are intercept and trend

Table 4: Result of Johansen cointegration test

Hypothesis	Trace Statistic	0.05 Critical Value	Prob.**
Trace Test			
r≤0	131.7046	47.85613	0.0000
r≤1	46.95484	29.79707	0.0002
r≤2	7.753062	15.49471	0.4922
r≤3	2.94E-05	3.841466	0.9979
Max-Eigen			
r≤0	84.74980	27.58434	0.0000
r≤1	39.20178	21.13162	0.0001
r≤2	7.753033	14.26460	0.4044
r≤3	2.94E-05	3.841466	0.9979

Trace and Max-eigenvalue tests indicate 2 cointegrating equations at the 0.01 level

The examination of the long-run coefficient parameters of the variables is conducted after finding out the presence of long-run cointegration of the series. For robustness purpose, two cointegration methods namely, FMOLS and CCR estimated and compared their results accordingly as reported in Table 5. The empirical results of FMOLS reveal that economic growth exerts a positive effect on energy consumption increase. A 1% increase in economic growth leads to energy consumption to increase 0.95% in the long-run. The canonical cointegration regression verifies and produces an asymptotically equivalent result. A 1% increase in economic growth results in energy consumption increasing by 0.85% in the long-run. The long-run results of economic growth on energy demand are in line with several previous studies (see; Adom et al., 2012; Konuk et al., 2021; Salari et al., 2021) who found that economic growth enhances energy consumption.

Furthermore, population growth tends to increase energy consumption of energy. As reported in Table 5, population growth has a significant positive effect on energy consumption in Somalia in the long-run. In FMOLS results, a 1% increase in population growth leads to an energy consumption by about 0.33% in the long-run. This result is verified by the findings of canonical cointegration regression which reports that 1% increase in population growth leads to an energy consumption to increase by about 0.31% in the long-run. These results are corroborated with Sarkodie and Adom (2018) and Rahman (2020) who concluded that population growth tends to rise energy consumption. On the contrary, urbanization effect on energy consumption is far from conclusive. Even though majority of the literature found out that urbanization leads to increase in energy consumption, but some others concluded that urbanization exerts a negative effect on energy consumption. In FMOLS results, it shows that urbanization affects energy consumption negatively. A 1% increase in urbanization leads to energy consumption to decrease by about 0.76% in Somalia in the long-run. In same vein, urbanization hampers energy consumption by about 0.80% in the long-run, if it is increased in 1% as shown by canonical cointegration regression. The adverse effect of urbanization on energy consumption is supported by several previous studies (Li and Lin, 2015; Poumanyvong and Kaneko, 2010). But it contradicts with numerous studies that revealed that urbanization enhances energy consumption (Sheng et al., 2017; Yu et al., 2020).

However, the rise in urbanization induces an increase in energy consumption in high-income countries. But in low-income countries, it impedes energy demand (Poumanyvong and Kaneko, 2010). Regarding our finding of the negative impact of urbanization on energy consumption seems to emphasize the presence of urban compaction, even though, the services of Somalia cities are yet to be fully functioning, hence, this omits the possibility that the negative effect of urbanization on energy demand results from the economies of scales for public infrastructure. But, it could be attributed to the modernization of using high efficiency and modern energy (Pachauri, 2004; Pachauri and Jiang, 2008).

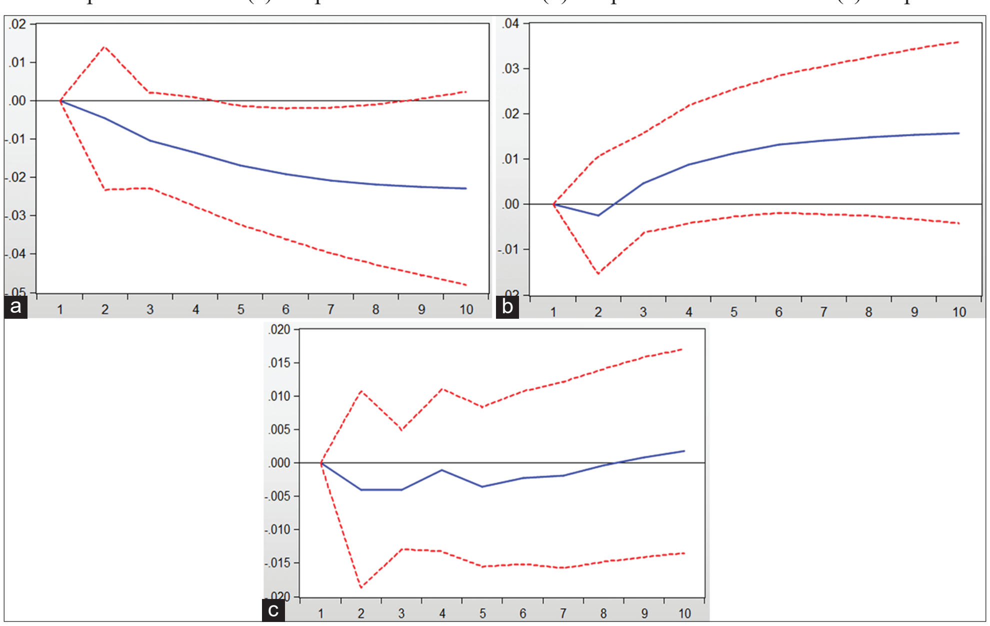
3.3. Impact Accounting

One of the limitations of Johansen multivariate cointegration, FMOLS and CCR are their lack of estimating the shock effects. To find out the shock effects of urbanization, economic growth and population growth on energy demand, we utilize impulse response function (IRF). The result of IRF reported in Figure 3 demonstrate that one standard deviation shock in urbanization (lnUB) results in energy consumption to decrease (lnEC) in the whole 10 periods. Hence, this result is in line with the long-run findings of FMOLS

Table 5: Long-run coefficient elasticities

Dependent Variable: lnSP			
Method		(FMOLS)	(CCR)
Variable		Coefficient	Coefficient
lnRGDPC		0.9476*** (−3.1518)	0.8472** (2.8140)
lnPG	0.3271**	(2.7794)	0.3132** (2.5307)
lnUB	−0.7593***	(−4.3895)	−0.7973*** (−4.3310)
Constant	3.7693**	(2.1570)	4.3737** (2.4228)
R−squared	0.2419	0.3140	
Adjusted R-squared		0.1385	0.2204
Long-run variance		0.0070	0.0070

Figure 3: Impulse Response Function. (a) Response of lnEC to lnUB (b) Response of lnEC to lnEG (c) Response of lnEC to lnPG



and CCR. Furthermore, it is established that energy consumption responds negatively for one standard deviation shock in population growth from period 1.5 to 2.5. But from period 2.5 and onwards, the response turns into positive. This is consistent with the long-run results which revealed that population growth leads to the increase in energy demand. On the contrary, one standard deviation shock in economic growth leads to decrease in energy consumption from the first period to 8.5 period. But from 8.5 the response of energy consumption to the shocks in economic growth becomes a positive.

4. CONCLUSION AND POLICY IMPLICATION

Somalia is emerging from a long period of civil war and conflicts. The urban population are growing and the cities are booming accompanied by increasing demand for energy consumption. There is a limited supply of energy to cover these growing demands. The relationship between energy demand and urbanization in Somalia is not understood. However, this study ascertains the role of urbanization in energy consumption in Somalia while accounting the role of economic growth and population growth in energy demand. To this end, FMOLS, CCR cointegration methods and IRF were employed with time-series data spanning 1990 to 2018 was also used. Before testing the long-run coefficients of the explanatory variables, we utilize Johansen multivariate cointegration method to establish the long-run cointegration of the scrutinized variables. The empirical results demonstrate that energy consumption, urbanization, economic growth and population growth are cointegrated in the long-run. Furthermore, the long-run results of FMOLS and CCR methods reveal that urbanization impedes the energy consumption in the long-run. In the same vein, the IRF shock effects of urbanization leads to energy consumption to respond negatively in the short-run which is consistent with the long-run findings. In contrast, economic growth and population growth tend to increase energy consumption in the long-run. Besides, it is established that energy consumption responds negatively for one standard deviation shock in population growth from period 1.5 to 2.5. But from period 2.5 onwards, the response turns into positive. This is consistent with the long-run results which revealed that population growth leads to an increase in energy demand. On the contrary, one standard deviation shock in economic growth leads to decrease in energy consumption from the first period to 8.5 period. But from 8.5 the response of energy consumption to the shocks in economic growth becomes a positive. This is contradictory with the long-run results which revealed that economic growth exerts a positive effect on energy consumption.

In light of this finding, to tackle the energy consumption – typically fusil fuel energy – and ensure the sustainable development in Somalia, energy policies relate to the reduction of firewood and charcoal should be instigated. Notably, firewood and charcoal are the main sources of energy consumption in Somalia. Hence, Somali policy makers should consider urbanization as an effective determinant while targeting energy conservation policy in order to mitigate the fossil fuel energy use. Moreover, a paradigm shift from nonrenewable energy to clean energy are also critical for sustainable economic growth and the growing demand for energy due to the rapid growth of the population and economy.

REFERENCES

Adom, P.K., Bekoe, W., Akoena, S.K.K. (2012), Modelling aggregate domestic electricity demand in Ghana: An autoregressive distributed lag bounds cointegration approach. Energy Policy, 42, 530-537.

African Development Bank. (2015), Somalia Energy Sector Needs Assessment and Investment Programme. Abidjan, Côte d'Ivoire: African Development Bank.

Al-Mulali, U., Fereidouni, H.G., Lee, J.Y.M., Sab, C.N.B. (2013), Exploring the relationship between urbanization, energy consumption, and CO_2 emission in MENA countries. Renewable and Sustainable Energy Reviews, 23, 107-112.

Aubrey, D., Cardoso, L. (2019), Towards Sustainable Urban Development in Somalia and IDP Durable Solutions at Scale. United Nations.

Federal Government of Somalia. (2015), Somalia's Intended Nationally Determined Contributions (INDCs). Villa Somalia: Federal Government of Somalia.

Konuk, F., Zeren, F., Akpınar, S., Yıldız, Ş. (2021), Biomass energy consumption and economic growth: Further evidence from NEXT-11 countries. Energy Reports, 7, 4825-4832.

Li, K., Lin, B. (2015), Impacts of urbanization and industrialization on energy consumption/CO_2 emissions: Does the level of development matter? Renewable and Sustainable Energy Reviews, 52, 1107-1122.

Liu, X., Sun, T., Feng, Q., Zhang, D. (2020), Dynamic nonlinear influence of urbanization on China's electricity consumption: Evidence from dynamic economic growth threshold effect. Energy, 196, 117187.

Lv, Y., Chen, W., Cheng, J. (2019), Modelling dynamic impacts of urbanization on disaggregated energy consumption in China: A spatial Durbin modelling and decomposition approach. Energy Policy, 133, 110841.

Madlener, R., Sunak, Y. (2011), Impacts of urbanization on urban structures and energy demand: What can we learn for urban energy planning and urbanization management? Sustainable Cities and Society, 1(1), 45-53.

Mrabet, Z., Alsamara, M., Saleh, A.S., Anwar, S. (2019), Urbanization and non-renewable energy demand: A comparison of developed and emerging countries. Energy, 170, 832-839.

Nguyen, D.T., Ngo, T.Q. (2019), Dynamics of household-level energy access in Vietnam during 2002-2014. International Journal of Energy Economics and Policy, 9(2), 132-145.

Pachauri, S. (2004), An analysis of cross-sectional variations in total household energy requirements in India using micro survey data. Energy Policy, 32, 1723-1735.

Pachauri, S., Jiang, L. (2008), The household energy transition in India and China. Energy Policy, 36, 4022-4035.

Park, J. (1992), Canonical cointegrating regressions. Econometrica, 60(1), 119-143.

Phillips, P.C.B., Hansen, B.E. (1990), Statistical inference in instrumental variables regression with i(1) processes. Review of Economic Studies, 57(1), 99-125.

Poumanyvong, P., Kaneko, S. (2010), Does urbanization lead to less energy use and lower CO_2 emissions ? A cross-country analysis. Ecological Economics, 70(2), 434-444.

Rahman, M.M. (2020), Exploring the effects of economic growth, population density and international trade on energy consumption and environmental quality in India. International Journal of Energy Sector Management, 14(6), 1177-1203.

Salari, M., Kelly, I., Doytch, N., Javid, R.J. (2021), Economic growth and renewable and non-renewable energy consumption : Evidence from the US states. Renewable Energy, 178, 50-65.

Sarkodie, S.A., Adom, P.K. (2018), Determinants of energy consumption in Kenya: A NIPALS approach. Energy, 159, 696-705.

Sbia, R., Shahbaz, M., Ozturk, I. (2017), Economic growth, financial development, urbanisation and electricity consumption nexus in UAE. Economic Research-Ekonomska Istrazivanja, 30(1), 527-549.

Shahbaz, M., Chaudhary, A.R., Ozturk, I. (2017), Does urbanization cause increasing energy demand in Pakistan? Empirical evidence from STIRPAT model. Energy, 122, 83-93.

Sheng, P., He, Y., Guo, X. (2017), The impact of urbanization on energy consumption and efficiency. Energy and Environment, 28(7), 673-686.

Torasa, C., Sittisom, W., Mekhum, W. (2020), What difference urban sprawl, industrialization and migration can make in energy consumption? A time-series analysis of Thailand. International Journal of Energy Economics and Policy, 10(5), 577-583.

Warsame, A.A., Sarkodie, S.A. (2021), Asymmetric impact of energy utilization and economic development on environmental degradation in Somalia. Environmenatl Science and Pollution Research, 67, 1–13.

Warsame, A.A., Sheik-Ali, I.A., Ali, A.O., Sarkodie, S.A. (2021), Climate change and crop production nexus in Somalia: An empirical evidence from ARDL technique. Environmental Science and Pollution Research, 28, 19838-19850.

World Bank. (2021), World Bank. Available from: https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=SO [Last accessed on 2021 Aug].

Yang, Y., Liu, J., Lin, Y., Li, Q. (2019), The impact of urbanization on China's residential energy consumption. Structural Change and Economic Dynamics, 49(2019), 170-182.

Yu, Y., Zhang, N., Dae, J. (2020), Impact of urbanization on energy demand: An empirical study of the Yangtze River economic belt in China. Energy Policy, 139, 111354.