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Access to Electricity and Economic Performance in West Africa: How do they relate?

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Abstract
The paper aims to determine the relationship between access to electricity and economic performance. The study covered 14 countries of the ECOWAS region and used data ranging from 1990 to 2016. The Pool Mean Group estimator, in an ARDL setting, was used to estimate the short and long run dynamics of access to electricity on growth. The analysis was done considering the currency, language and geographical divide. Results show cointegration among variables. In the long run, access to electricity positively impacts economic growth but not in the short run. There is a long run causality going from access to electricity to economic performance. Access to electricity has no significant impact on economic growth when the sample is disaggregated to capture the currency, language and geographical divide. From the findings, we recommend that the authorities of the region endeavor to increase investment in energy infrastructure to substantially improve access rate.

Keywords: energy, economic growth, PMG, ECOWAS
JEL. Classification: O13, Q43, O47, C23

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I. INTRODUCTION

The demand for energy has been rising swiftly around the world due to economic growth and increasing population level. The theory of Economic development by Joseph Schumpeter makes it clear that the economy is a dynamic system which is based on the new technological and organizations innovation environment. In this scenario Solow model also tried to explain the gap between growth in economic output, which is mostly because of capital and labor (Foxon and Steinberger, 2011).

However, with the advancement in technology, one key driver of technological progress is energy and hence access to electricity. Without access to electricity, many businesses may not be able to prosper. Health centers may not be able to operate efficiently without basic electricity. Thus, electricity could be a life saver and hence an essential element in human capital development. Indeed, throughout the years, electricity has been responsible for powering phones, electric lights, heaters, computers, televisions, pacemakers, cars etc.

Access to electricity refers to the percentage of people in a given area that have relatively simple, stable access to electricity[1]. It can also be referred to as the electrification rate. Put simply, electricity transfers energy from a power plant (primary energy) to a house or a business (end use of energy).

Utilization of electricity provides greater opportunities and leads to increase in its demand. Energy helps in improving the standard of living through various modern services of energy (OECD, 2011). It also contributes to economic growth by enabling increases in the productivity of factors of production i.e. capital and labor, and proffering opportunities for job creation. Energy provides input to most of the goods and services in an economy. An economy can be stimulated with the help of energy which when it is at relatively lower and stable prices reduces expense for both consumers (in terms of affordability) and businesses (lower costs) (World Economic Forum, 2012).

Due to lack of accessibility to modern, reliable and sustainable energy forms and electricity for that matter, there has been an existence of developmental issues such as inequality, poverty, global warming, insecurity of food, health and education (Bazilian. et al.. 2010; Hailu, 2012). With the help of modern energy

[1] https://energyeducation.ca/encyclopedia/Access_to_electricity

services, most of the developmental issues can be addressed and this is visible in many developed economies (IEA 2014).

For social and economic development in Africa, in line with its rising population and economic growth prospects more and more energy is required. Thus, energy and its access are among the key barriers to Africa development. In West Africa, about fifty percent of the population has access to electricity. In East Africa about three quarters and most of Southern Africa does not have access to electricity (IRENA, 2015, WEO, 2015).

West Africa consists of 16 countries with two regional organizations with a population of more than 330 million, representing 35% of Sub-Saharan African population. For African countries, services sector might be considered as an engine for economic growth, however, for West Africa, manufacturing sector is a significant contributor towards industrialization (West Africa Economic Outlook, 2019). Thus, the energy sector is considered as one of the most important integration factor (European Commission). In West African economies, most of the energy comes from charcoal, firewood, electricity and petroleum. In which the share of woodfuel is 70 percent, petroleum 23 percent and electricity about 7 percent (Kebede et al. 2010). With global warming and its effect on the environment utilization of charcoal and firewood as means of energy is being more and more discouraged. A shift should be made toward electricity. Unfortunately, access to electricity in West Africa is still minimal compared to other region of the world. Indeed, in 2009 58% of West African countries (excluding Mauritania) did not have access to electricity (N'Zué 2014). For West Africa to overcome social and economic challenges, investment in energy to improve its accessibility will be a booster of economic growth (Vilar, 2012).

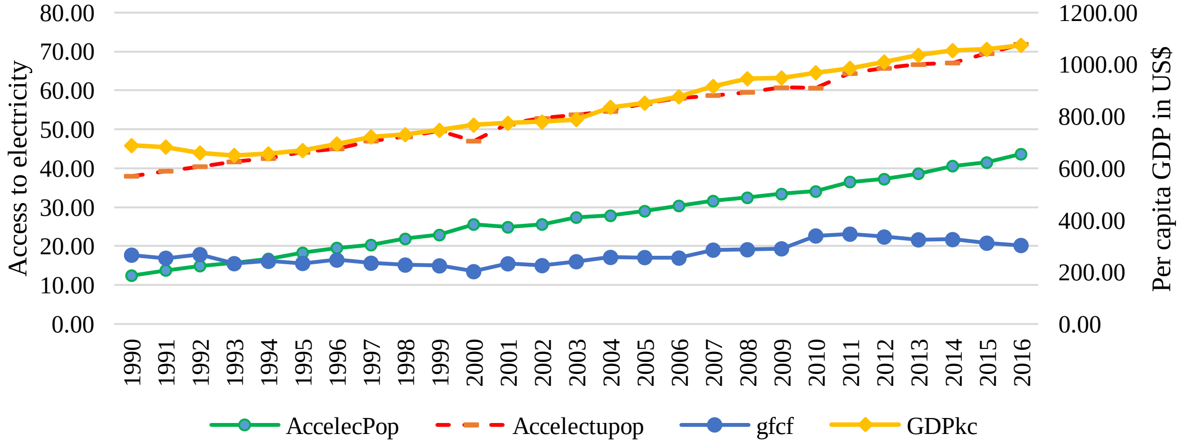
In line with the above, the present study's main objective is to contribute to a better understanding of the relationship between access to electricity and economic performance with a focus on West Africa. More specifically, the study seeks to determine the impact of population's access to electricity on economic performance measured as per capita Gross Domestic Product (GDP). The results of this study will enable us to advocate for more investment in the supply of energy to enable more access to electricity given the challenges that the region is confronted with (N'Zué 2014). The rest of the paper is organized as follows: Section 2 presents stylized facts on the nexus between access to electricity and economic performance in the ECOWAS region and then disaggregate it on the basis of currency utilization, language and geography. Section 3 provides a brief review of literature whereas section 4 presents the data to be used and methods of analysis. Section 5 discusses the empirical results and section 6 concludes the paper.

II. STYLIZED FACTS

This section provides trend analysis of access to electricity as well as investment and per capita Gross Domestic Product (GDP) in the ECOWAS region. The region as a whole is first analyzed and then disaggregated based on geography, language and currency. In the latter case the distinction is made between CFA countries and non CFA countries. It is observed in Figure 1 that population's (and urban population) access to electricity has been on the rise since 1990 throughout the entire period. This provides indication of efforts made at the regional level to ensure that a significant number of people enjoy electricity. In 1990, population's access to electricity stood at only 12.48%. This figure rose to 43.65% in 2016 which is a 249.76% increase over the period of analysis. It is important to note that this 43.6% access is below the Sub Saharan Africa average which stood at 44.6%[2] (World Bank 2020). Over the same period of time, urban population's access to electricity went from 38% in 1990 to 69.47% in 2015 (77.55% increase).

[2] https://data.worldbank.org/indicator/eg.elc.accs.zs

Figure 1. Trend of population's access to electricity, per capita GDP and investment (as % of GDP) in the ECOWAS region from 1990 to 2016

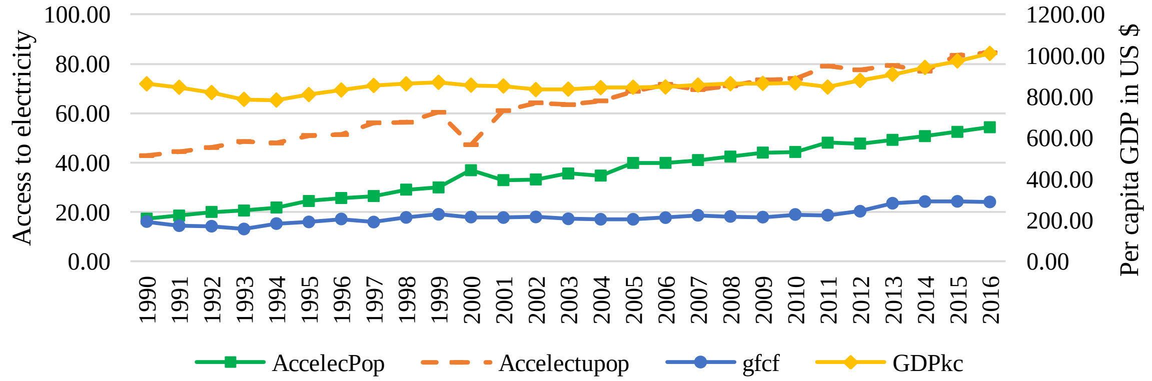


Sources: Authors with data from World Development Indicators 2020.

We can also observe that the regional per capita GDP has been also upward sloping after a decline from 1990 where it stood at 687.98 US$ to a level of 650.27 US$ in 1993. Unlike the above trends, investment measured as Gross Fixed Capital Formation (GFCF) remained low compared to that of emerging economies. Indeed, it never passed the bar of 25%. It stood at 17.73% of GDP in 1990, dropped to 13.5% in 2000, climbed to its highest level at 23.13% in 2011 and started another decline that continued till 2016 where it stood at 20.22%. For comparison purposes, GFCF as percent of GDP stood at 31% for East Asia and the Pacific countries[3].

In what follows, we disaggregated the data to distinguish between Coastal French speaking CFA countries and landlocked French speech speaking countries. This is done to bring out any difference that could be attributed to geographical differences. The Coastal French Speaking and CFA countries include Benin, Cote d'Ivoire, Senegal and Togo. The trends for these four countries are depicted in Figure 2. We can observe that population's access to electricity is also upward sloping. It went from 17.28% in 1990 to 54.28% in 2016 above the sub Saharan Africa average and also above the ECOWAS region's average indicated earlier. Per capita GDP and investment are both upward sloping.

Figure 2. Trend of population's access to electricity, investment and per capita GDP for French speaking, coastal and CFA countries from 1990 to 2016



Sources: Authors with data from World Development Indicators 2020.

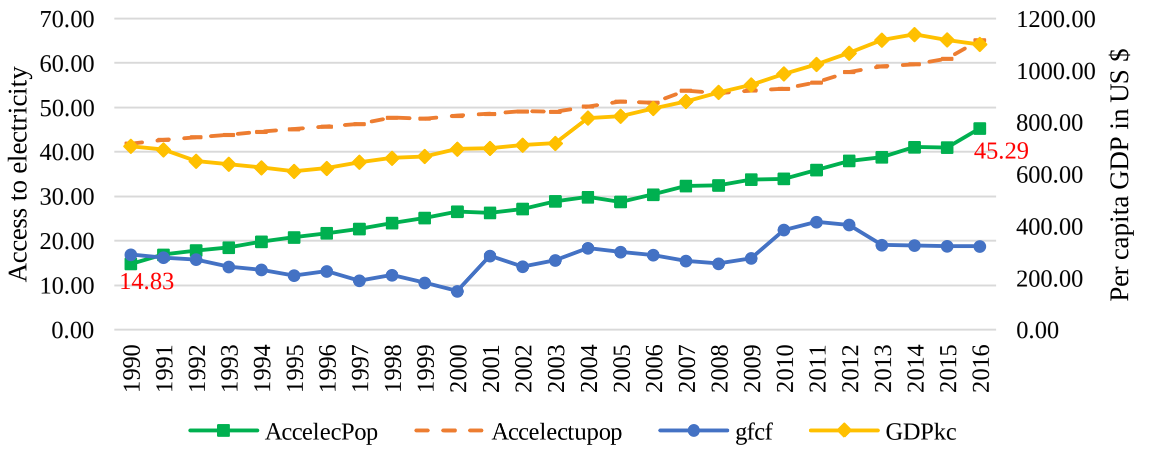
All the English speaking countries in ECOWAS are coastal and use their own currencies. These countries are Gambia, Ghana, Liberia, Nigeria and Sierra Leone. Their trends are presented in Figure 3. Access

[3] https://data.worldbank.org/indicator/NE.GDI.FTOT.ZS?view=map

to electricity in these countries follows the same pattern as that of French speaking countries i.e. upward sloping. In 1990, only 14.83% of the population had access to electricity. Level that is below that of the French speaking countries for the same year. By 2016 the proportion of the population with access to electricity has risen to 45.29% but still below that of the French Speaking countries which stood at 54.28% in 2016.

Per capita GDP after a period of decline going from 1990 to 1995, registered an upward sloping trend afterwards till 2014 where it reached its peak at 1,138.59 US$. It started to decline again thereafter and stood at 1,100 US$ in 2016 above per capita GDP of the French Speaking CFA countries. On the investment side, we observe that it has not been smooth. Indeed, in 1990, it stood at 16.88% of GDP and dropped to 8.66% of GDP in 2000 its lowest level. After 2000, it started and upward sloping trend that took it to its highest level at 24.21% in 2011 before falling afterwards to reach 18.75% of GDP in 2016 below that of the French Speaking CFA countries that stood at 24.04% in the same year.

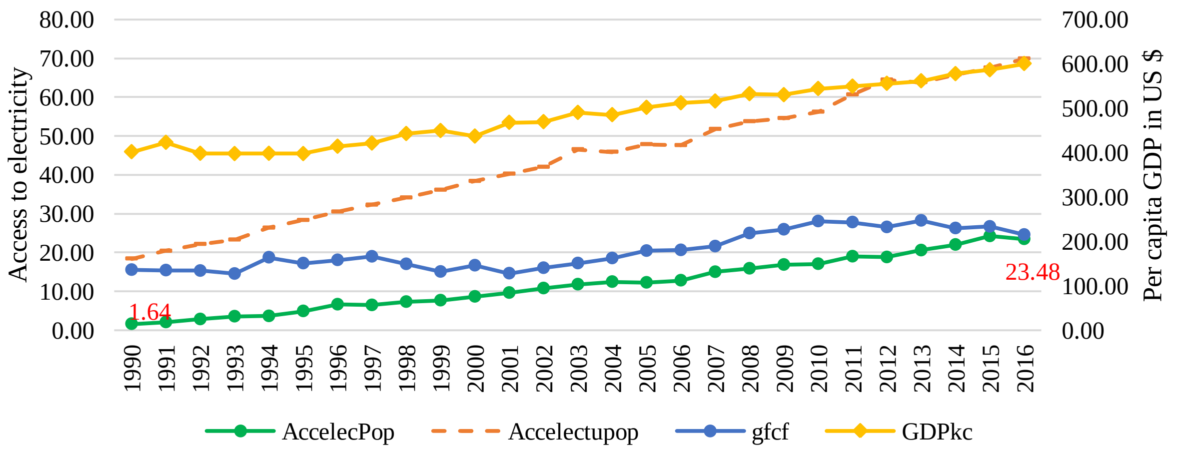
Figure 3. Trend of population's access to electricity, investment and per capita GDP for English speaking countries from 1990 to 2016



Sources: Authors with data from World Development Indicators 2020.

We turn to landlocked countries (Figure 4). These are Burkina Faso, Mali and Niger. Although access of their population to electricity is upward sloping over the period of analysis, it is important to note that access is extremely low compared to other countries. Indeed, in 1990 it stood at only 1.64% and reached only 23.48% in 2016. Investment in these countries stood at 15.55 in 1990 and moved to 24.59% in 2016 with a peak of 28.23% in 2013. Despite its low level, investment in these countries was above not only the regional average but also above that of coastal CFA countries. Per capita GDP in these countries registered an upward sloping trend throughout the period of analysis.

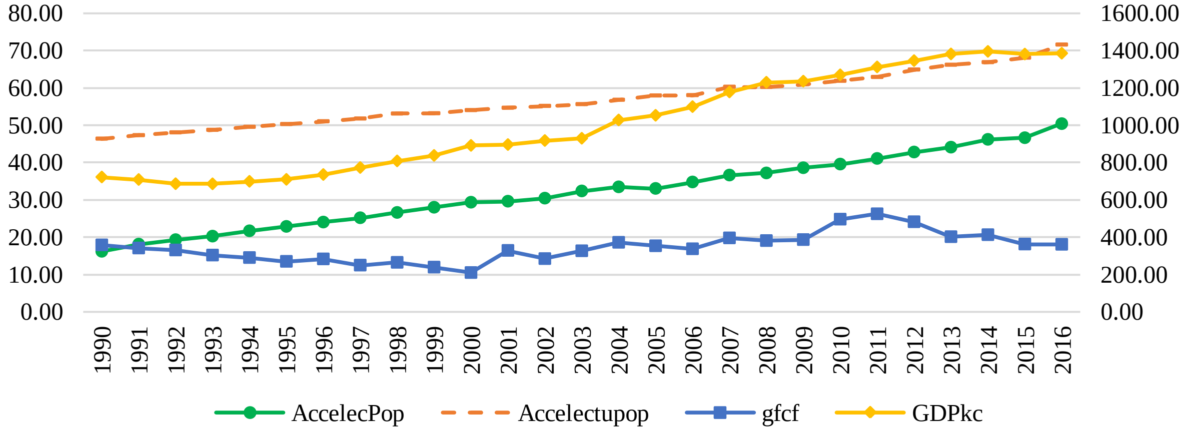
Figure 4. Trend of population's access to electricity, investment and per capita GDP for French speaking inland countries from 1990 to 2016



Sources: Authors with data from World Development Indicators 2020.

When we observe non CFA countries (Figure 5), per capita GDP and population's access to electricity are all upward sloping. For these countries, access to electricity stood at 16.19% in 1990 and climbed to 50.37% in 2016 representing a 211% increase over the period of analysis. On the investment side. We observe three episodes. The first one goes from 1990 to 2000 where investment registered a sharp decline going from 17.89% in 1990 to 10.48% in 2016. From 2000 to 2011 (second episode) we observe an upward sloping trend up to a peak in 2011 where it stood at 26.22%. From 2011 going forward we observe a decline of investment from its 2011 level to 18.04% in 2016 which is below that of CFA countries.

Figure 5. Trend of population's access to electricity, investment and per capita GDP for non CFA countries from 1990 to 2016



Sources: Authors with data from World Development Indicators 2020.

III. REVIEW OF LITERATURE

For the development of an economy whether rich or poor, reliable energy is one of the main objectives. Today's global economy is motivated by the energy. Fossil fuels are one of the source to meet the demand for energy (Frankhausher and Jotzo, 2017). Different forms of energy also help in creating opportunities for jobs and investment. In this regard Dvorak et.al. (2017) found that the sector of renewable energy has an impact over the creation of jobs, especially the greener way. Further, it is argued that increases in the level of employment is directly related to investment in the renewable industry. Various studies found a causal relationship between energy consumption and economic growth; however, direction of causality has not been defined.

Ntanos et. al. (2018) in a study on the relationship between energy consumption derived from renewable energy and economic growth, using data ranging from 2007 to 2016 for 25 European countries in an ARDL setting found that in the long run there is a positive correlation between GDP and renewable energy and non-renewable energy sources, GFCF and labor force. Further, it shows that higher GDP economies have stronger correlation with renewable energy sources and economic growth compared to economies with lower GDP.

Stern and Cleveland (2004) say that for economic production, energy is important according to physical theory. By applying time series analysis their study found that GDP and energy are cointegrated and when variables like energy prices and other inputs of production are added, energy use Granger causes GDP. According to their report, to achieve greener growth, policy framework should be adopted which can lead to changes in the energy sector in the form of innovative technological transformation and formation of new industries and markets. Further, there should be reduction in carbon intensity of different sectors (OECD, 2011).

Foxon and Steinberger (2011) discuss the role of high quality and cheaper energy forms in revolutionizing the growth of an economy for both emerging and industrialized economy. Their study highlighted that economic analysis based on neoclassical approach does not consider energy as a production factor. However, the economic impact is significant because of low-carbon alternatives and increased input costs. Through applying co-evolutionary approach, their study found out that cheap energy for economic growth can be a reason as well as the outcome.

Kalyoncu (2013) studied the relationship between economic growth and energy consumption for Aerbaijan, Armenia and Georgia and found that for Georgia and Azerbaijan, there is no relationship for the said variables, however they are related for Armenia and unidirectional causality has been found from GDP per capita towards energy consumption per capita.

Zhang, et.al. (2017) studied the relationship between economic growth and energy consumption for three industries in Beijing. In the short run, they found bidirectional causality while in the long run, unidirectional causality was observed from energy consumption to economic growth.

Jakovac (2018) found that the various economic theories did not take in to account the role of energy on economic growth.

Saidi, et al. (2018) studied the association between economic growth and energy with the help of institutional measures using panel cointegration. They found that the variables used are cointegrated and causality runs from energy and institutional measures other than law and order to economic growth. Also, there is causality from economic growth to energy considering all institutional measures.

The economies of West Africa are mostly energy poor as around fifty percent of the population does not have access to energy services of the modern era. Fatai (2014) and Wolde-Rufael (2004) studied the causal relationship between economic growth and energy consumption in eighteen Sub Saharan African economies. They found long run relationship between energy consumption and economic growth. Unidirectional causality was found for South and East Africa sub region from energy consumption to economic growth. On the other hand, for West Africa and Central Africa sub region there was no causality.

Salim et al. (2014) and Kyeremeh (2016) using OECD data investigated the relationship among the level of energy consumption, economic growth and industrial production. They found that in short run, there is a two way relationship between growth of GDP and conventional energy consumption, while in the long run energy consumption, industrial production and economic growth are linked.

Twerefou, et al. (2018) said that in West Africa, to achieve economic growth and sustainable development, reliable energy supply plays a significant role. Using panel cointegration, they found no causal relationship from electricity, total energy and petroleum consumption to economic growth in the short run. Though, unidirectional causality from economic growth to electricity consumption is found in the short run. Further, petroleum and electricity have significant and positive impact on the growth in the long run, making way for policies in this direction.

It results from the above brief review that broadly speaking access to electricity and energy consumption have a positive impact on economic performance. How does this apply to countries in the ECOWAS region? The next section presents the data used and methods of analysis applied.

IV. DATA AND METHODS OF ANALYSIS

The data used for this study was obtained from the World Development Indicators 2020 (World Bank 2020)[4]. It ranged from 1990 to 2016 i.e. 26 years (***T***) and 14[5] countries (***N***) thus ***T>N***. We investigate its time series characteristics. This entails testing for unit roots. We conducted both first and second generation unit root tests. The first generation unit root tests assume cross sectional independence whereas the second generation tests assume cross sectional dependence. Given the data at our disposal, we estimated an *ARDL (p, q, q, q,…,q)* model that captures both short and long run effects of population's access to electricity and economic performance in ECOWAS members States.

In its general form, the *ARDL (p, q, q, q,…,q)* model takes following form:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (1)$$

for $i = 1, 2, \ldots, N$; $t = 1, 2, \ldots, T$, where i is the cross section dimension (the individual countries) and t the time series dimension, x_{it-j} is a $k \times 1$ vector of explanatory regressors for group i, μ_i represent the fixed effects, the coefficients of the lagged dependent variables, λ_{ij}, are scalars and δ_{ij} are $k \times 1$ coefficient vectors. T must be large enough to enable the estimation of the model for country separately. Our explanatory variables included the conventional growth determinants i.e. capital and labor where capital (investment) is measured as Gross Fixed Capital Formation ($lninv_{it}$) and labor measured as Labor Force Participation Rate ($lnlab_{it}$). These variables are in the model to ensure it is not misspecified. We included in our model a set of control variables i.e. "population's access to electricity" ($lnacelec_{it}$), openness ($lnopen_{it}$) and life expectancy ($lnlife_{it}$) a proxy for human capital development. All the original variables were transformed in to logarithm. Given our objective of capturing both short and long run effect of access to electricity on economic performance we can reparameterize equation 1 into an error correction model (Blackburne et al. 2007) as :

$$\Delta y_{it} = \phi_i [y_{i,t-1} - \theta'_i X_{it}] + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-1} + \sum_{j=0}^{q-1} \delta'^*_{ij} \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (2)$$

Where $\phi_i = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right)$, $\theta_i = \sum_{j=0}^{q} \delta_{ij} / \left(1 - \sum_k \lambda_{ik}\right)$, $\lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im}$ $j = 1, 2, 3, ---, p-1$, and $\delta^*_{ij} = -\sum_{m=j+1}^{q} \delta_{im}$ $j = 1, 2, 3, ---, q-1$.

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[4] The data that support the findings of this study are available from the corresponding author (NFF), upon reasonable request.

[5] Cabo Verde was excluded from the analysis due to insufficient data on the Gross Fixed Capital Formation variable.

The parameter ϕ_i is the group (country) specific speed of adjustment coefficient and it is expected to be < 0. If $\phi_i = 0$, there is no evidence for a long run relationship. This parameter is expected to be negative and significant. θ_i' is a vector of long run relationships. λ_{ij}^*, $\delta_{ij}'^*$ are the short run dynamic coefficients.
In line with the above our model is specified as follows:

$$\Delta lngdpkc_{it} = \phi_i\left[lngdpkc_{i,t-1} - \theta_i'\boldsymbol{X}_{it}\right] + \sum_{j=1}^{p-1}\lambda_{ij}^*\Delta lngdpkc_{i,t-1} + \sum_{j=0}^{q-1}\delta_{ij}'^*\,\Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (3)$$

Equation 3 is estimated using the Pool Mean Group Estimator (PMG) which is an intermediate estimator between the Dynamic Fixed Effect estimator (DFE) and the Mean Group Estimator (MG). Indeed, on one hand the MG estimator produces consistent estimates of the averages of the parameters. However, it does not take account of the fact that some parameters may be the same across groups (Pesaran et al 1998). On the other hand the DFE estimator allows intercepts to differ across groups while other coefficient and error variances are constrained to be the same. The PMG involves both pooling and averaging and allows the intercepts, short run coefficients and error variances to differ freely across groups but the long run coefficient are constrained to be the same (Pesaran et al 1998). For the purpose of comparison, we also estimated equation 3 using the MG estimator and use the Hausman test to determine the most appropriate estimator to use. Our empirical results are presented below.

V. EMPIRICAL RESULTS

In this section we discuss our results under four angles: We first consider all the countries regardless of currency, geography or language. Then we proceed to disaggregate the analysis in line with the currency, geography and language divides. Tables 1 and 2 present descriptive statistics and pairwise correlation matrix for all the 14 countries. We observe that on average over the period of analysis only 24.78% of the region's population has access to electricity. This rate is quiet low if we assume that to develop a strong private sector encompassing micro, small and medium enterprises, access to electricity is among the critical factors. Without electricity, the people in these countries are denied the opportunities to fully develop their businesses.

On the correlation side, we observe that access to electricity is positively correlated with per capita GDP. That positive correlation is high (0.77) and statistically significant at the 1% probability level. We can also observe that access to electricity is positively correlated with Exports and life expectancy. These correlations are statistically significant.

Table 1. Descriptive statistics for the whole sample (all the countries)

Variables	Mean	Std. Dev.	Min	Max	Observations
gdpkc	726.479	436.681	115.790	2563.090	N = 378
accelec	**24.783**	18.836	0.010	**79.300**	N = 378
gfcf	17.531	7.344	0.289	48.400	N = 378
X	26.767	10.879	4.900	82.450	N = 378
M	39.048	24.031	10.490	236.390	N = 378
labpr	67.3168	9.617	52.420	85.090	N = 378
life	53.414	5.733	35.710	67.150	N = 378

Source: Authors' calculations

Table 2. Pairwise correlation matrix among variables of interest

Variables	*gdpkc*	*accelec*	*gfcf*	*X*	*M*	*labpr*	*life*
gdpkc	1.000						
accelec	0.774	1.000					
	(0.000)						
gfcf	-0.091	0.046	1.000				
	(0.078)	(0.368)					
X	0.316	0.453	-0.041	1.000			
	(0.000)	(0.000)	(0.421)				
M	-0.211	-0.069	0.248	0.521	1.000		
	(0.000)	(0.180)	(0.000)	(0.000)			
labpr	-0.275	-0.190	0.126	-0.208	-0.1261	1.000	
(0.000)	(0.000)	(0.014)	(0.000)	(0.014)			

life	0.081 (0.118)	0.379 (0.000)	0.491 (0.000)	0.124 (0.016)	0.288 (0.000)	0.101 (0.050)	1.000

Source: Authors' calculations

We move to test for Cross Sectional Independence (Tables 3 and 4.). Table 3 gives test results for three different tests i.e. Pesaran, Frees and Friedman. It is important to note that these tests are undertaken only after estimation of a fixed effect or random effect panel data model. Thus, "**Fe**" and "**Re**" stand for fixed effects and random effects respectively. With the exception of Pesaran's test which is significant at 10% probability level, the over two tests reject the null hypothesis of cross sectional independence at the 1% probability. The results are supportive of cross-section dependence in the sample.

An alternative test of cross-sectional independence is the one known as Pesaran CD test (Table 4). The difference with the previous tests is that it undertakes the test for each variable and hence give more information than the previous one. We observe that with the exception of the labor participation rate variable for which we cannot reject the null hypothesis of Cross sectional independence, the test strongly rejects the null hypothesis for the remaining variables. Given these results we will consider in what follows methods that account for these heterogeneities. We analyzed the time series characteristics of the data using both first and second generation unit root tests. The results are presented in Table 5.

Table 3. Results of different tests for Cross-Sectional Independence.

		All countries	
		Fe	**Re**
Pesaran	Stat	1.737	1.824
	p-value	(0.082)	(0.068)
Frees	Stat.	4.383	4.412
	Crit. Val. @ 5%	0.124	
Friedman	Stat	32.483	32.624
	p-value	(0.002)	(0.001)

Source: Authors' calculations

Table 4. Results of Pesaran *CD* tests for Cross-Sectional Independence

Variables	**Test Stat**	**P-values**
$lngdpkc_t$	20.010	(0.000)
$lninv_t$	3.320	(0.001)
$lnlab_t$	1.270	(0.203)
$lnopen_t$	8.070	(0.000)
$lnlife_t$	43.010	(0.000)
$lnelec_t$	43.920	(0.000)

Source: Authors' calculations

The first generation panel Unit root tests do not account for cross section dependence unlike the second generation tests. Under the first generation test, the variables $lngdpkc_t$, $lninv_t$ $lnlab_t$, $lnopen_t$ and $lnlife_t$ are *I(1)* in the specification without trend. However, in the specification with trend only $lngdpkc_t$ and $lnlab_t$ variables are *I(1)*. With the second generation test without trend specification, the variables $lngdpkc_t$, $lninv_t$ $lnlab_t$, $lnopen_t$ and $lnlife_t$ are *I(1)*. With the trend specification the variables $lngdpkc_t$, $lnlab_t$, $lnopen_t$ and $lnlife_t$ are *I(1)* and two variables are *I(0)*. These are $lninv_t$ and $lnelec_{t.}$ Given that we have a mixture of *I(0)* and *I(1)* variables, we used an *ARDL* with Error Correction to assess the existence of cointegration among the variables. Results of the *ARDL* estimation are presented in Table 6.

Table 5. Results of First and Second Generation Unit Root tests using the entire sample

Variables	lags	Without trend Statistics	Without trend P-values	Status	With trend Statistics	With trend P-values	Status
First generation Unit Root Test (Maddala and Wu)							
$lngdpkc_t$	0	13.729	(0.989)	I(1)	31.025	(0.316)	I(1)
	1	18.515	(0.912)	I(1)	48.486	(0.009)	I(1)
$lninv_t$	0	65.378	(0.000)	I(0)	81.291	(0.000)	I(0)
	1	39.981	(0.066)	I(1)	53.441	(0.003)	I(0)
$lnlab_t$	0	20.602	(0.842)	I(1)	40.734	(0.057)	I(1)
	1	22.737	(0.746)	I(1)	36.829	(0.123)	I(1)
$lnopen_t$	0	62.134	(0.000)	I(0)	79.826	(0.000)	I(0)
	1	32.865	(0.241)	I(1)	44.929	(0.022)	I(0)
$lnlife_t$	0	38.800	(0.084)	I(1)	45.083	(0.022)	I(0)
	1	244.677	(0.000)	I(0)	494.577	(0.000)	I(0)
$lnelec_t$	0	288.474	(0.000)	I(0)	182.902	(0.000)	I(0)
	1	140.259	(0.000)	I(0)	136.727	(0.000)	I(0)
Second generation Unit root tests (CIPS)							
$lngdpkc_t$	0	0.589	(0.722)	I(1)	1.510	(0.934)	I(1)
	1	-0.005	(0.498)	I(1)	1.461	(0.928)	I(1)
$lninv_t$	0	-2.858	(0.002)	I(0)	-4.344	(0.000)	I(0)
	1	-1.227	(0.110)	I(1)	-2.402	(0.008)	I(0)
$lnlab_t$	0	3.196	(0.999)	I(1)	0.968	(0.834)	I(1)
	1	1.343	(0.910)	I(1)	-0.617	(0.269)	I(1)
$lnopen_t$	0	-3.245	(0.001)	I(0)	-1.623	(0.052)	I(0)
	1	-1.045	(0.148)	I(1)	1.342	(0.910)	I(1)
$lnlife_t$	0	-0.606	(0.272)	I(1)	2.394	(0.992)	I(1)
	1	-11.347	(0.000)	I(0)	-6.043	(0.000)	I(0)
$lnelec_t$	0	-8.794	(0.000)	I(0)	-7.786	(0.000)	I(0)
	1	-3.956	(0.000)	I(0)	-2.510	(0.006)	I(0)

Source: Authors' calculations

The Hausman test conducted favors the *PMG* estimator. Hence, we focused our analysis on results obtained with the *PMG* estimator. Let's start with the error correction term i.e. *ECT*. The error correction term is the adjustment speed toward the steady state after a choc. It can be used to assess the cointegration status of the variables. Theoretically the *ECT* should be negative and significant. When that is the case then we conclude that the variables in the model are cointegrated. Here, the coefficient for the *ECT* is **-0.322** with a probability value of **0.006** which is less than the 5%. We therefore reject the null hypothesis of no cointegration relation among the variables. We conclude that there are both long run and short run dynamics among the variables. Let's look at the long run coefficients. With the exception of the labor participation rate variable, all other variables are significant in the long run. We observe that the coefficient associated with the investment variable ($lninv_t$) is negative and significant. This is contrary to our expectation. Indeed, we expected investment to be positively associated with growth. What this results indicate is that investment in the ECOWAS region has not been pro-growth. The variables openness ($lnopen_t$) and life expectancy ($lnlife_t$) have both positive and significant impact on economic growth in the long run.

Table 6. Long run and short run effect of population's access to electricity on Economic Growth. Estimator: Mean Group (*MG*) and Pool Mean Group (*PMG*). Dynamic Specification: ARDL(2,2,3,2,1,0) for the entire sample.

Variables	MG Coefficient	MG P-value	PMG Coefficient	PMG P-value
Long run dynamics				
$lninv_t$	1.097	(0.177)	**-0.122*****	**(0.000)**
$lnlab_t$	-160.419	(0.352)	-0.042	(0.789)
$lnopen_t$	-1.344	(0.301)	**0.304*****	**(0.000)**
$lnlife_t$	-19.221	(0.232)	**0.777*****	**(0.000)**
$lnelec_t$	-5.512	(0.336)	**0.110*****	**(0.000)**
ECT	**-2.237**	**(0.000)**	**-0.322*****	**(0.006)**
Short run dynamics				

$\Delta lngdpkc_t$ (-1)	0.687	(0.014)	0.065	(0.481)
$\Delta lngdpkc_t$ (-2)	0.406	(0.132)	-0.094*	(0.095)
$\Delta lninv_t$	**-0.423*****	**(0.000)**	**0.042*****	**(0.048)**
$\Delta lninv_t$ (-1)	**-0.239*****	**(0.000)**	**0.025*****	**(0.028)**
$\Delta lninv_t$ (-2)	**-0.133*****	**(0.000)**	0.029*	(0.067)
$\Delta lnlab_t$	15.471	(0.203)	**-10.278*****	**(0.036)**
$\Delta lnlab_t$ (-1)	7.835	(0.163)	1.441	(0.704)
$\Delta lnlab_t$ (-2)	-10.896	(0.636)	-1.609	(0.812)
$\Delta lnlab_t$ (-3)	-23.447	(0.425)	5.482	(0.478)
$\Delta lnopen_t$	**0.352****	**(0.027)**	**-0.109*****	**(0.003)**
$\Delta lnopen_t$ (-1)	0.201	(0.095)	**-0.077*****	**(0.010)**
$\Delta lnopen_t$ (-2)	0.028	(0.514)	-0.049*	(0.093)
$\Delta lnlife_t$ (-1)	-18.139	(0.181)	3.638	(0.384)
$\Delta lnelec_t$	-0.073	(0.281)	-0.014	(0.634)
Intercept	45.336	(0.370)	**0.735*****	**(0.005)**
Hausman Test	$\chi^2_{(5)} = 1.62$ and p-value = 0.89 ➔ PMG			
No. Countries	14			
No. Observations	322			

Source:. Authors' calculations. Number in parenthesis are p-values. Asterisk indicate significant levels, thus * 10%, ** ➔ 5% and *** ➔ 1 %

Population's access to electricity ($lnelec_t$) has a positive and significant impact on economic growth in the long run but not in the short run. In the short run our results indicate that changes in investment positively and significantly affect economic growth in the region. Government are therefore encouraged to increase investment given its short term beneficial effects on growth. Labor force participation rate is here again negatively associated with growth indicating that the labor force is not engaged in productive activities that could boost the region's economic performance. Unlike in the long run, in the short run openness has a negative impact on economic growth. Life expectancy is not significant in the short run.

It results from the above analysis that although in the short run the impact of access to electricity on economic growth is not perceptible, the impact is more obvious in the long run. The regional authorities are therefore encourage to ensure that a greater percentage if not all has access to electricity.

Let's now turn to the currency divide and see to what extent population's access to electricity impact countries differently (Table 7). In both CFA and non CFA countries we observe that the error correction terms are negative and significant indicating the existence of long run dynamics. In the long run population's access to electricity has a positive impact on economic growth for CFA countries. However, it is not significant in non CFA countries. In the short run, the impact of access to electricity on economic growth in CFA countries is negative and significant only at the 10% probability level whereas it is not significant in the non CFA countries.

Table 7. Long run and short run effect of population's access to electricity on Economic Growth. Estimator: Mean Group (*MG*) and Pool Mean Group (*PMG*). Dynamic Specification: *ARDL*(2,2,3,2,1,0) for CFA and non CFA countries

Variables	CFA countries				Non CFA countries			
	MG		*PMG*		*MG*		*PMG*	
	Coeft	P-value	Coeft	P-value	Coeft	P-value	Coeft	P-value
Long run dynamics.								
$lninv_t$	**0.521****	**(0.018)**	**0.096*****	**(0.006)**	1.865	(0.333)	**-0.487*****	**(0.000)**
$lnlab_t$	3.661	(0.542)	**-1.819*****	**(0.001)**	-379.194	(0.348)	1.335	(0.650)
$lnopen_t$	**-0.136*****	**(0.001)**	**0.127****	**(0.048)**	-2.953	(0.334)	**0.605*****	**(0.000)**
$lnlife_t$	1.120	(0.360)	**-0.489****	**(0.042)**	-46.342	(0.200)	**4.889****	**(0.013)**
$lnelec_t$	0.183	(0.023)	**0.049*****	**(0.001)**	-13.105	(0.327)	0.088	(0.767)
ECT	**-2.704*****	**(0.000)**	**-0.545****	**(0.014)**	**-1.616****	**(0.026)**	-0.020	(0.810)
Short run dynamics								
$\Delta lngdpkc_t$ (-1)	0.595	(0.124)	0.019	(0.895)	0.811	(0.061)	0.009	(0.953)
$\Delta lngdpkc_t$ (-2)	0.091	(0.782)	-0.008	(0.902)	0.825	(0.049)	**-0.264****	**(0.023)**
$\Delta lninv_t$	**-0.589*****	**(0.000)**	-0.029	(0.534)	**-0.202****	**(0.046)**	0.017	(0.621)
$\Delta lninv_t$ (-1)	**-0.350*****	**(0.000)**	-0.014	(0.633)	-0.091	(0.294)	0.001	(0.965)
$\Delta lninv_t$ (-2)	**-0.164*****	**(0.005)**	**0.040***	**(0.090)**	**-0.091****	**(0.013)**	-0.019	(0.388)
$\Delta lnlab_t$	21.700	(0.288)	-4.809	(0.295)	7.165	(0.458)	-11.632	(0.186)
$\Delta lnlab_t$ (-1)	-3.439	(0.393)	-4.647	(0.182)	**22.869****	**(0.011)**	9.009	(0.116)
$\Delta lnlab_t$ (-2)	-38.607	(0.298)	-4.169	(0.701)	**26.052****	**(0.047)**	2.870	(0.422)
$\Delta lnlab_t$ (-3)	-42.418	(0.411)	7.012	(0.605)	1.848	(0.788)	**6.003***	**(0.088)**
$\Delta lnopen_t$	**0.502****	**(0.026)**	**-0.123*****	**(0.001)**	0.152	(0.472)	-0.017	(0.761)
$\Delta lnopen_t$ (-1)	**0.322****	**(0.039)**	**-0.077***	**(0.058)**	0.039	(0.827)	-0.014	(0.590)
$\Delta lnopen_t$ (-2)	0.045	(0.402)	**-0.092****	**(0.013)**	0.005	(0.949)	0.017	(0.718)

$\Delta lnlife_t$ (-1)	0.323	(0.984)	1.894	(0.677)	**-42.756****	**(0.040)**	4.212	(0.201)
$\Delta lnelec_t$	-0.076	(0.105)	**-0.056***	**(0.092)**	-0.069	(0.656)	0.022	(0.765)
Intercept	-9.976	(0.903)	8.323**	(0.014)	**119.086****	**(0.000)**	-0.425	(0.801)
Hausman Test	$\chi^2_{(5)} = 3.98$ and p-value = 0.55 ➔ PMG				$\chi^2_{(5)} = 5.63$ and p-value = 0.228 ➔ PMG			
No. Countries			8			6		
No. Observations			184			138		

Source: Authors' calculations. Number in parenthesis are p-values. Asterisk indicate significant levels, thus * 10%, ** ➔ 5% and *** ➔ 1 %

When we considered the geographical divide i.e. Coastal and non-coastal countries (Table 8), we observe that the error correction terms are negative and significant indicating the existence of long run dynamics. However, in both short and long run, population's access to electricity has no significant impact on economic growth in the two groupings.

Table 8. Long run and short run effects of population's access to electricity on Economic Growth. Estimator: Mean Group (*MG*) and Pool Mean Group (*PMG*). Dynamic Specification: *ARDL*(2,2,3,2,1,0) for Coastal and landlocked countries

Variables	Coastal countries				Non Coastal countries			
	MG		*PMG*		*MG*		*PMG*	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coeft	P-value
				Long run Coefficient.				
$lninv_t$	1.294	(0.212)	0.001	(0.832)	**0.376****	**(0.020)**		
$lnlab_t$	-201.871	(0.359)	**-0.457****	**(0.035)**	-8.431	(0.157)		
$lnopen_t$	-1.687	(0.308)	**0.121*****	**(0.000)**	-0.084	(0.209)		
$lnlife_t$	-24.035	(0.239)	**1.019*****	**(0.000)**	-1.568	(0.473)		
$lnelec_t$	-7.046	(0.334)	0.001	(0.954)	0.113	(0.282)		
ECT	-1.981***	(0.001)	**-0.513****	**(0.025)**	**-3.178*****	**(0.008)**		
				Short run Coefficient				
$\Delta lngdpkc_t$ (-1)	0.579**	(0.051)	**0.294****	**(0.017)**	1.086	(0.176)		
$\Delta lngdpkc_t$ (-2)	0.424	(0.193)	0.075	(0.525)	0.338	(0.496)		
$\Delta lninv_t$	-0.366***	(0.000)	-0.002	(0.942)	**-0.631*****	**(0.000)**		
$\Delta lninv_t$ (-1)	-0.193***	(0.009)	0.016	(0.262)	**-0.409*****	**(0.000)**		
$\Delta lninv_t$ (-2)	-0.118***	(0.006)	0.014	(0.543)	**-0.186****	**(0.010)**		
$\Delta lnlab_t$	17.332	(0.263)	**-6.837***	**(0.071)**	8.646	(0.247)		
$\Delta lnlab_t$ (-1)	9.351	(0.189)	2.053	(0.510)	2.278	(0.326)		
$\Delta lnlab_t$ (-2)	-14.411	(0.626)	-2.672	(0.732)	1.993	(0.323)		
$\Delta lnlab_t$ (-3)	-34.377	(0.352)	9.128	(0.281)	16.630	(0.222)		
$\Delta lnopen_t$	0.346*	(0.079)	**-0.056****	**(0.012)**	0.376	(0.114)		
$\Delta lnopen_t$ (-1)	0.192	(0.202)	**-0.069****	**(0.045)**	0.235	(0.131)		
$\Delta lnopen_t$ (-2)	0.019	(0.663)	**-0.049****	**(0.011)**	0.058	(0.659)		
$\Delta lnlife_t$ (-1)	-20.428	(0.174)	1.246	(0.765)	-9.749	(0.794)		
$\Delta lnelec_t$	-0.084	(0.323)	-0.014	(0.658)	-0.032	(0.653)		
Intercept	14.871	(0.777)	**1.892****	**(0.024)**	157.039	(0.257)		
Hausman Test	$\chi^2_{(5)} = 1.46$ and p-value = 0.918 ➔ PMG				PMG estimation did not converge			
No. Countries				11			3	
No. Observations				253			81	

Source: Authors' calculations. Number in parenthesis are p-values. Asterisk indicate significant levels, thus * 10%, ** ➔ 5% and *** ➔ 1 %

Now let's consider the language divide (French and English). The results are presented in Table 9. The coefficient associated with the error correction term is negative but not significant for the Francophone countries whereas it is negative and significant for the Anglophone countries. Thus, for the Francophone countries there are no long run dynamics. We therefore concentrate on the short run dynamics. We observe that in the short run only investment has a positive and significant impact on economic performance. Access to electricity has no significant impact on economic performance.

In the Anglophone countries, the error correction term is negative and significant. This is supportive of the existence of long run dynamics among the variables. The variable of interest is positive but not significant both in the long and short run.

Table 9. Long run and short run effects of population's access to electricity on Economic Growth using Mean Group (*MG*) and Pool Mean Group (*PMG*) estimators. The dynamic specification is an *ARDL*(2,2,3,2,1,0) for French and English speaking countries.

Variables	**French Speaking countries**				**English speaking countries**			
	MG		***PMG***		***MG***		***PMG***	
	Coeft	P-value	Coeft	P-value	Coeft	P-value	Coeft	P-value
				Long run Coefficient.				
$lninv_t$	**0.523****	**(0.017)**	**-0.306*****	**(0.001)**	2.203	(0.343)	0.008	(0.305)

$lnlab_t$	0.678	(0.913)	**-0.908*****	**(0.004)**	-452.581	(0.353)	**-1.904*****	**(0.000)**
$lnopen_t$	**-0.095*****	**(0.001)**	**-0.393****	**(0.043)**	-3.536	(0.336)	**-0.077*****	**(0.000)**
$lnlife_t$	0.266	(0.807)	**2.646*****	**(0.000)**	-55.316	(0.197)	**0.994*****	**(0.000)**
$lnelec_t$	**0.193****	**(0.013)**	0.011	(0.273)	-15.738	(0.327)	0.012	(0.599)
ECT	**-2.114*****	**(0.000)**	-0.283	(0.112)	**-1.571***	**(0.076)**	**-0.993****	**(0.044)**
Short run Coefficient								
$\Delta lngdpkc_t$ (-1)	0.467	(0.193)	0.060	(0.607)	0.855	(0.105)	**0.653****	**(0.020)**
$\Delta lngdpkc_t$ (-2)	-0.049	(0.854)	0.084	(0.498)	0.927*	(0.063)	**0.393****	**(0.012)**
$\Delta lninv_t$	**-0.510*****	**(0.000)**	0.098	(0.132)	-0.174	(0.143)	0.019	(0.444)
$\Delta lninv_t$ (-1)	**-0.311*****	**(0.000)**	**0.098****	**(0.020)**	-0.050	(0.592)	0.0001	(0.993)
$\Delta lninv_t$ (-2)	**-0.169*****	**(0.003)**	**0.118*****	**(0.001)**	**-0.084***	**(0.055)**	**-0.035***	**(0.088)**
$\Delta lnlab_t$	3.524	(0.478)	-4.055	(0.431)	5.521	(0.635)	-9.710	(0.229)
$\Delta lnlab_t$ (-1)	0.059	(0.989)	-2.834	(0.393)	**24.536****	**(0.024)**	**10.427*****	**(0.000)**
$\Delta lnlab_t$ (-2)	-0.215	(0.923)	5.115	(0.469)	**29.434***	**(0.058)**	10.538	(0.139)
$\Delta lnlab_t$ (-3)	8.489	(0.122)	-1.809	(0.495)	1.114	(0.894)	5.268	(0.261)
$\Delta lnopen_t$	**0.259*****	**(0.007)**	-0.021	(0.764)	0.182	(0.478)	**0.076*****	**(0.009)**
$\Delta lnopen_t$ (-1)	**0.136****	**(0.049)**	-0.009	(0.869)	0.077	(0.722)	**0.050***	**(0.084)**
$\Delta lnopen_t$ (-2)	0.039	(0.496)	-0.057	(0.218)	0.029	(0.737)	**0.059***	**(0.088)**
$\Delta lnlife_t$ (-1)	-8.552	(0.493)	-0.388	(0.845)	**-50.842****	**(0.031)**	-8.629	(0.213)
$\Delta lnelec_t$	**-0.080***	**(0.076)**	-0.008	(0.835)	-0.082	(0.664)	-0.0300	(0.628)
Intercept	57.064	(0.328)	0.541	(0.117)	**119.549*****	**(0.002)**	**10.312****	**(0.043)**
Hausman Test	$\chi^2_{(5)} = 1.40$ and p-value = 0.924 ➔ PMG				$\chi^2_{(5)} = 1.64$ and p-value = 0.801 ➔ PMG			
No. Countries			8				5	
No. Observations			184				115	

Source: Authors' calculations. Number in parenthesis are p-values. Asterisk indicate significant levels, thus * 10%, ** ➔ 5% and *** ➔ 1 %

It results from the above discussion of the empirical findings that when all the ECOWAS countries are taken together, there is a long run causality running from population's access to electricity to economic growth. But in the short run, access to electricity has no significant impact on economic growth. Even when the data is divided to take into account the currency, geographical and language differences the impact of access to electricity is not consistent throughout. In all the cases considered we did not find significant impact of access to electricity on economic growth. This results could be due to the fact that having access to electricity does not necessarily meaning that electricity is used for production activities. It is just a presumption. Thus, a better way to capture the extent to which energy impact economic growth could be through an investigation of the energy consumption and economic growth nexus.

VI. CONCLUSIONS AND POLICY IMPLICATIONS

The main objective of this paper was to contribute to the debate on the extent to which access to electricity has a bearing on economic performance. The study focused on fourteen out of fifteen countries in the Economic Community of West African States (ECOWAS). Cabo Verde is the country excluded due to lack of data. The period of analysis ranged from 1990 to 2016. The authors used the Pool Mean Group (*PMG*) estimator in an *ARDL* with error correction setting to estimate the short and long run dynamics of the traditional growth model augmented with a variable on access to electricity. The paper took into account the peculiarities of the region. These peculiarities have to do with currency utilization (CFA versus non CFA countries), language (French versus English) and geography (Coastal versus Landlocked).

It was observed that population's access to electricity in the region was quiet low on average (24.78%) despite efforts in some countries where the rate of access reach 79.3%. It is also observed that the association between access to electricity and per capita GDP (a proxy for economic performance) is positive (0.77) and significant. The test for cross sectional independence yielded ambiguous results. Indeed, some tests rejected the null hypothesis of cross sectional independence whereas others failed to reject it. The first and second generation unit root tests conducted provided evidence for the existence of both *I(0)* and I*(1)* series and justified the use of the ARDL with error correction model. The dynamic specification retained is the *ARDL(2,2,3,2,1,0)*.

The results of the PMG estimation provided support for both short run and long run dynamics among the variables. Most importantly, we found that population's access to electricity ($lnelec_t$) has a positive and significant impact on economic growth in the long run but in the short run the impact is not significant. Thus, authorities are encouraged to implement policies (i.e. investment in infrastructure, open their economies to the outside world and improve human capital) to improve access to electricity. When the data was disaggregated into specific groupings we obtained the following results:

- For both CFA and non CFA countries, the variables are cointegrated justifying the existence of long run dynamics. Population's access to electricity has a positive impact on economic growth for CFA countries in the long run but not for non CFA countries. In the short run, the impact of access to electricity on economic growth in CFA countries is negative and significant whereas it is not significant in the non CFA countries.

- For Coastal and non-coastal countries we have evidence supporting the existence of long run dynamics. However, population's access to electricity has no significant impact on economic growth in both groupings neither in the long run nor in the short run.
- When we consider the language divide, the results suggest that access to electricity has no significant impact on economic performance in both Francophone and Anglophone countries.

Overall, it appears that when all countries are pooled together, access to electricity has a positive and significant impact on economic growth. This is supportive of the ongoing regional initiative to find regional solutions to the problem of low access to electricity. The paper therefore recommends increased effort in investment to ensure an access rate in the neighborhood of 99%.

Data Availability

Datasets related to this article are available from the corresponding author (Felix Fofana N'Zué), upon reasonable request.

REFERENCES

[1]. Bazilian et al. (2010). *Measuring Energy Access: Supporting a Global Target*. The Earth Institute, Columbia University, New York, USA. Retrieved from http://us-cdn.creamermedia.co.za/assets/articles/attachments/28017_bazilian_et_al_2010_measuring_energy_access_supporting_a_global_target.pdf.

[2]. Blackburne E.F. and M.W. Frank (2007), Estimation of Nonstationary heterogeneous panels, *The Stata Journal* Vol. 7 (2):197-208

[3]. Dvořák, P., Martinát, S., Van der Horst, D., Frantál, B., Turečková, K. (2017). Renewable Energy Investment and Job Creation; A Cross-Sectoral Assessment for the Czech Republic with Reference to EU Benchmarks. *Renewable and Sustainable Energy Reviews*, Vol. 69 pp. 360-368.

[4]. Fatai, B.O.(2014). Energy Consumption and Economic Growth nexus: Panelco-integration and causality tests for Sub-Saharan Africa. *Journal of Energy in Southern Africa*, Vol. 25 (4). Retrieved from http://www.erc.uct.ac.za/sites/default/files/image_tool/ images/119/ jesa/25-4jesa-Fatai.pdf

[5]. Foxon, J. T. and Steinberger, J. K. (2011). The role of Energy in Economic Development: A Co-Evolutionary Perspective. European Association for Evolutionary Political Economy (EAEPE). Vienna.

[6]. Frankhausher, S. and Jotzo, F. (2017). Economic Growth and Development with Low Carbon Energy. Centre for Climate Change Economic and Policy Working Paper No. 301 and Grantham Research Institute on Climate Change and the Environment, Working Paper No. 267.

[7]. Hailu, Yohannes G. (2012). Measuring and Monitoring Energy Access: Decision-Support Tools for Policymakers in Africa. *Energy Policy* Vol. 47 pp. 56–63. Retrieved from https://doi.org/10.1016/j.enpol.2012.03.065

[8]. IEA. 2014. World Energy Outlook 2014, pp.144.

[9]. IRENA. (2015). AFRICA 2030: Roadmap for a Renewable Energy Future. Retrieved from https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA_Africa_2030_REmap_2015_low-res.pdf

[10]. Jakovac, Pavle. (2018). Causality between Energy Consumption and Economic Growth: Literature Review. Proceedings of INTCESS2018- 5th International Conference on Education and Social Sciences 5-7 February 2018- Istanbul, Turkey

[11]. Kalyoncu, H. (2013). Causality Relationship between GDP and Energy Consumption in Georgia, Azerbaijan and Armenia. *International Journal of Energy Economics and Policy*, 3(1):111-117.

[12]. Kebede, E., Kagochi, J. and Jolly, C.M. (2010). Energy Consumption and Economic Development in Sub-Sahara Africa. *Energy Economics* Vol. 32(3): 532–37. Retrieved from https://doi.org/10.1016/j.eneco.2010.02.003.

[13]. Kyeremeh, H. (2016). West Africa's Energy Sector Developments: Does the Sub-Regionalized approach to energy provision provide the optimal option towards the attainment of Energy Access and Security?. Graduate School of Public Policy. The University of Tokyo. Retrieved from http://www.pp.u-tokyo.ac.jp/wp-content/uploads/2016/02/51168230.pdf.

[14]. N'Zué F. Fofana (2014). Formulating a Regional Policy for Energy and Technology / Innovation: What Role for Taxation. *WAI-ZEI Paper* No. 16. ISBN 978-3-941928-46-6.

[15]. Ntanos S., Skordoulis M., Kyriakopoulos G., Arabatzis G., Chalikias M., Galatsidas S., Batzios A.and Katsarou A. (2018) Renewable Energy and Economic Growth: Evidence from European Countries, *Sustainability*, 10, 2626; doi:10.3390/su10082626.

[16]. OECD .(2011). OECD Greeen Growth Studies: Energy. Retrieved from https://www.oecd.org/greengrowth/greening-energy/49157219.pdf
[17]. Pesaran M.H., Y. Shin and R. P. Smith (1998), Pooled Mean Group Estimation of Dynamic Heterogeneous Panels, Edinburgh School of Economics. Discussion Paper No.16. Retrieved from http://www.ed.ac.uk/schools-departments/economics.
[18]. Saidi, H., Montasser, G. E. and Ajmi, A. N. (2018). Renewable Energy, Quality of Institutions and Economic Growth in MENA Countries: A Panel Cointegration Approach. MPRA paper no.84055. Retrieved from https://mpra.ub.uni-muenchen.de/84055/
[19]. Salim, R.A.; Hassan, K.; Shafiei, S.(2014). Renewable and Non-Renewable Energy Consumption and Economic Activities: Further evidence from OECD countries. *Energy Economics*, Vol. 44 pp. 350–360.
[20]. Stern D. and Cleveland C. J., (2004), Energy and Economic Growth, Rensselaer Working Papers in Economics, Rensselaer Polytechnic Institute, Department of Economics. Retrieved from https://econpapers.repec.org/scripts/showcites.pf?h=repec:rpi:rpiwpe:0410
[21]. Twerefou, D.K., Iddrisu, K.S. and Twum, E.A. (2018). Energy Consumption and Economic Growth: Evidence from the West African Sub Region. West *African Journal of Applied Ecology*, vol. **26**(SI).
[22]. Vilar (ed). (2012). Renewable Energy in Western Africa: Situation, Experiences and Trends, ECREEE and Casa Africa. Retrieved from www.ecreee.org/sites/default/files/renewable _energy_in_west_africa_0.pdf
[23]. WEO. (2015). WEO 2015 Electricity Access Database. Retrieved from http://www.worldenergy outlook.org/resources/energydevelopment/energyaccessdatabase/
[24]. West Africa Economic Outlook. (2019). Macroeconomic Performance and Prospects: Regional Integration and Structural Transformation in West Africa. African Development Bank Group. Retrieved from https://www.afdb.org/fileadmin/uploads/afdb/Documents /Publications/ 2019AEO/REO_2019_-_West_africa.pdf
[25]. Wolde-Rufael, Y. (2004). Energy Demand and Economic Growth: The African Experience, *Journal of Policy Modelling*, Vol. 27, pp. 891-903.
[26]. World Bank (2020). Retrieved from https://data.worldbank.org/indicator/eg.elc.accs.zs
[27]. World Economic Forum. (2012). Energy for Economic Growth: Energy Vision Update 2012. Retrieved from http://www3.weforum.org/docs/WEF_EN_Energy EconomicGrowth _IndustryAgenda_2012.pdf
[28]. Zhang, X., et.al. (2017).Causality between Energy Consumption and Economic Growth in Beijing: Evidence from Cross-Industry Panel Data, International Conference on Computer Science, Environment, Eco-informatics and Education, CSEE 2011, Vol 217, pp 233-237.

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