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Renewable Energy and Economic Growth: The Role of Foreign Direct Investment in Sub-Saharan Africa

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Abstract
One of the concerns of governments in developing countries is to ensure energy independence by all means in order to boost economic growth. Particular attention is paid to renewable energies. This paper analyzes the contribution of foreign direct investment (FDI) to growth through the consumption of renewable energy. We use therefore a GMM estimation in system on panel data from 30 Sub-Saharan African countries over the period 2017 to 2021. The results show that the existence of the positive double causality between energy consumption and economic growth, are mixed for our sample. The results show also that, in presence of the foreign direct investments, the consumption of renewable energy positively affects the economic growth in sub-Saharan African countries. This effect prevails for all countries despite the heterogeneous levels of renewable energy consumption and the different transitions in the adoption of the consumption of these energies. Public policies should focus on the promotion of renewable energies consumption and investments in that way for a significant increase in the national product.

Keywords: Renewable energy, Economic growth, FDI, Sub-Saharan Africa, MMG

JEL classification: O13, O38, Q48, C23

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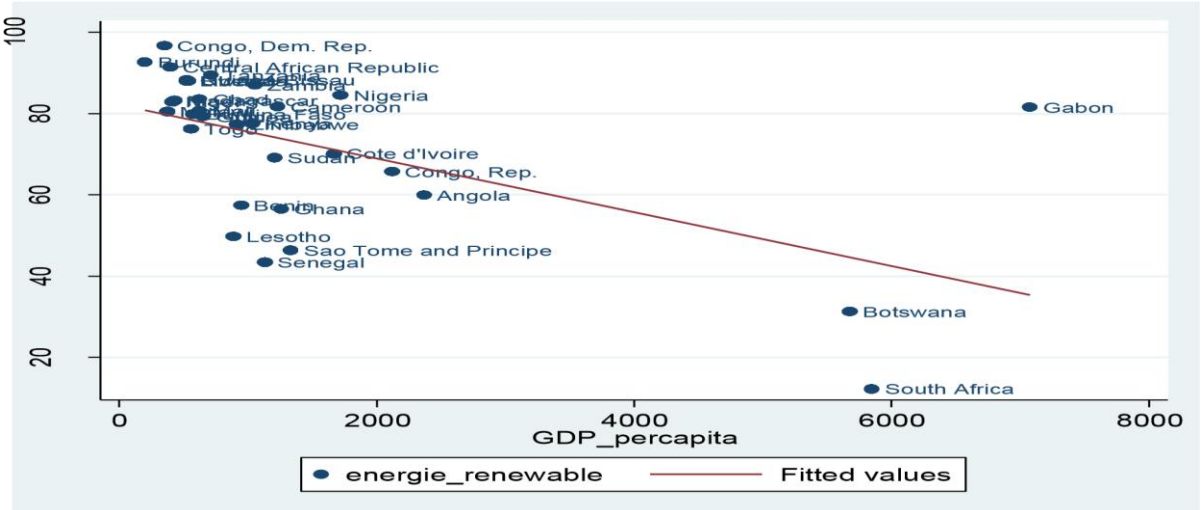
1. Introduction

Energy is needed to meet basic human needs, including protection from temperature extremes, for the use of machinery of all kinds, and for lighting. Businesses (small and medium-sized), industries, commerce and public services, such as modern health care, education and communication, are expressing ever-increasing needs for energy services. This demand pressure is linked, on the one hand, to population growth in the Sub-Saharan Africa (SSA) sub region and, on the other hand, to the need for states to develop their embryonic industrial fabric in order to reduce unemployment. The strong and rapid growth of the urban population over the past decades must also be accompanied by the modernization of reception structures likely to create sustainable economic opportunities.

The various energy crises of recent years have affected both modern and developing economies. This dependence on fuel energy (coal, gas or oil) makes African economies vulnerable and cannot guarantee sustainable development. Fossil energy does not guarantee an optimal supply in several African countries, so that, according to the World Bank (2017), the number of people without access to electricity is about 600 to 700 million and is expected to increase by 2050. In this context, the use of renewable energy is strategic as it not only meets the demand of SSA populations for modern and reliable energy services, but also reduces costs, energy dependency, and environmental and health impacts. The potential for renewable energy is high. The reserves of hydraulic energy, 1100 TWh are exploited at only 8% while the potential in geothermal energy of the Rift Valley, estimated at 9 GW is exploited at only 6%. Africa has serious assets in terms of solar energy; the average sunshine of African countries is twice as high as in Europe, with an average ranging between 1750 KWh/m^2 /year and 2500 KWh/m^2 /year against 1150KWh/m^2 /year for Germany. In addition, no less than seven of the ten sunniest countries in the world are African, including Chad, Egypt and Kenya (IRENA, 2021).

As a result, Africa has no choice but to turn to renewable energy for economic growth and development. Figure 1 below effectively shows the strong mutual dependence between renewable energy consumption and economic growth in SSA. Significant investments are needed to move away from fuel dependency. However, it is unlikely that African countries will be able to find the resources to finance such investment growth from conventional sources, including private or public domestic savings. It is therefore imperative to find other sources of financing. To this end, States can resort to internal resources via banks and the stock market, to public development aid or attract international private investment, i.e. foreign direct investment (FDI). The latter are indicated to hope to boost economic growth through the production and consumption of renewable energy. According to Marouane et al. (2009), FDI stimulates growth through its contribution to value added and through the productivity gains generated by technology transfers to local companies as well as through the training of the workforce.



Source: authors.

Figure 1 - Renewable Energy and Economic Growth

This paper seeks to assess the nature of the relationship between renewable energy consumption and economic growth and then to identify the role of FDI in this quest for energy independence in SSA. FDI is an important aspect of development financing that is best suited to the analysis of renewable energy production because it requires innovative technology and skilled labor.

Increasing renewable energy production reduces the production costs of all goods and services and thus increases economic growth. This work complements the literature on economic growth and energy in general. This literature takes little or no account of the financing of development through FDI, which could be a way out of the energy dependence of SSA countries.
The article is structured as follows: section 2 presents the literature review, section 3 gives the methodology, section 4 the econometric results and interpretations. Finally, section 5 concludes with the main lessons and perspectives.

2. Review of the literature

The last decades have seen the emergence of debates related to the causal relationships between energy consumption and economic growth or sustainable development. Two trends have emerged in the literature. Some authors demonstrate that the consumption of all kinds of energy affects economic growth. Others find, there are proponents of the inverse relationship, i.e., economic growth inducing energy consumption, or of the existence of a double causal link between the two variables. Another category of studies has focused on the relationship between economic growth and renewable energy consumption according to methodologies that vary according to the samples selected.

Apergis and Payne (2010) in examining a relationship between renewable energy consumption and growth used twenty OECD countries[1] as their sample for analysis over the period 1985-2005. These two authors chose to use the error correction model and cointegration techniques to assess possible causal links. The various tests reveal that there is a balanced long-run relationship between real GDP, renewable energy consumption, gross fixed capital formation and employment. They find that there is a two-way causal relationship between renewable energy consumption and economic growth.

In another study Aspergis and Danuletiu (2014) for the first time investigate the links between renewable energy and economic growth for a sample of 80 countries using the long-run analysis of Canning and Pedroni (2008). They find that there is a positive long-term causality from renewable energy to real Gross Domestic Product (GDP) for the entire sample. The results indicate that renewable energy is essential for economic growth and similarly, economic growth leads to the use of a more renewable energy source. This result allows for the promotion of renewable energy. More recently, Allam and Nader (2021) investigate the same question on the relationship between renewable energy and GDP per capita for selected Mediterranean countries over the period 1990-2015. Using descriptive statistics and cluster analysis, the authors find that there is a long-run relationship between GDP and the variables determining renewable energy consumption. They conclude that there is a positive correlation between different renewable energy sources and economic growth for both low and high income countries.

Examining the case of 29 European countries, Kasperowicz et al. (2020) used various panel unit root and cointegration tests as well as modified and dynamic ordinary least squares estimators. The results demonstrate the existence of a long-run balanced relationship between renewable energy consumption and economic growth. The authors therefore suggest that public policies should promote renewable energies to ensure sustainable development objectives.
Beyond the previous typology oriented towards developed countries (Inglesi-Lotz 2016; Aper and Oguz 2016; Chen et al., 2020; Davidson et al., 2021) other studies have focused on emerging countries like Bouyghrissi et al. (2021) and Destek (2016). Eyuboglu and Uzar (2022) analyze the

[1] Organization for Economic Cooperation and Development

causal relationships between renewable energy consumption and economic growth in 15 emerging countries over the period 1990-2015 using bootstrap techniques[2] developed by Konya (2006). The results validate the neutrality hypothesis in all countries and the asymmetry analysis between the variables shows causality from negative economic growth shocks to negative renewable energy consumption shocks in South Africa, Turkey and Thailand so that a negative shock to economic growth also hinders renewable energy consumption in these countries.

A systematic synthesis of the literature on the issue was conducted by Bhuiyan et al. (2022). The authors, after reviewing 46 papers according to the PRISMA guidelines[3] over the period 2010 to 2020, conclude that renewable energy contributes to growth in both developing and developed countries. However, the impact of renewable energy consumption in developed countries on growth is small compared to that of developing countries due to a threshold effect. This means that when the country has reached a certain level of development through fossil energy, an increase in the consumption of renewable energy can only marginally increase economic growth.

It should also be noted that a recent work, which stands out from the crowd, studies the relationships between renewable energy consumption, financial development and economic growth in 12 countries of the International Energy Agency (IEA) over the period 1996-2017. Koç et al. (2022) use the ARDL model[4] to understand the cointegration relationships between the variables. The results show that economic growth positively affects renewable energy consumption in the short run and the panel causality test demonstrates a short-run relationship between renewable energy consumption and financial development indicators.

Finally, only one study in this empirical literature addresses almost the same issue with the only difference being that it deals with fossil fuels instead of renewable energy. Omri and Kahouli (2013) examined the causality between energy consumption, foreign direct investment and economic growth for a sample of 65 countries around the world over the period 1990-2011 using the dynamic panel data model with simultaneous equations. For this purpose, 3 subgroups of countries were constituted to make the different panels more homogeneous: the group of high-income countries, the group of middle-income countries and the group of low-income countries. The authors finally show that the results of the investigation of a possible relationship between energy consumption and foreign direct investment are mixed in all cases.

From the above, we can conclude that the relationship between renewable energy and economic growth is likely to be positive with magnitudes that vary according to the level of development of the countries and in some cases the causality is bi-directional as renewable energy drives economic growth and vice versa. The analysis of the impact of renewable energy consumption on economic growth via the foreign direct investment channel has not been studied in SSA. This paper fills the gap in the economic literature in investigating the investment channel.

[2] In statistics, bootstrap techniques are statistical inference methods based on multiple replication of data from the dataset under study, using resampling techniques. This method is based on stochastic simulations, such as MonteCarlo methods.

[3] Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

[4] ARDL: Autoregressive Distributed Lag/ARDL or autoregressive models with staggered or distributed delays (ARRE) in French.

3. Methodology

3.1. Econometric model

The contribution of foreign direct investment to growth through the consumption of renewable energy is the focus of this paper. We consider the specification of a production model integrating endogenous factors in the sense of the Cobb Douglas model. However, this specification is based on the developments of the Romer growth model and particularly those of Broensztein et al. (1998) taking into account foreign direct investments as variables of technology transfer in the growth process. Considering the panel of SSA countries in the sample, the model can be specified as follows:

$$y_{it} = f(K_{it}, l_{it}, E_{it}) \quad (1)$$

y_{it} is the variable of the economic production or growth of country *i* considered at period *t*. K_{it} ; l_{it} *and* E_{it} are respectively defined as the physical capital, the human capital and the energy consumption in the process of the growth and/or the economic production of each country *i* at the period *t* considered. In order to highlight the contribution of renewable energy consumption in economic growth, several control variables will be taken into account. These variables will be defined by the X_{it} matrix of the groups of variables. The consumption of renewable energies (*Energy_ren*) is therefore the variable of interest considered.

$$y_{it} = f(y_{it-1}, \mathrm{X}_{it}, Energy\_ren_{it}) + \varepsilon_{it} \quad (2)$$

In order to study the impact of foreign direct investment on economic growth through the consumption of renewable energy in Sub-Saharan Africa, the econometric model to be estimated will be specified as follows:

$$txpib_{it} = \alpha_0 + \alpha_1 txpib_{it-1} + \alpha_2 Energy\_ren_{it} + \alpha_3 IDE_{it} + \alpha_4 Energy\_ren * IDE_{it} + \alpha_5 Infl_{it} + \alpha_6 Cell_{it} + \alpha_7 \mathrm{Re}mit\tan ce_{it} + \alpha_8 Pop_{it} + \alpha_9 Ouv_{it} + \varepsilon_{it} \quad (3)$$

The following table gives the definition of the different variables of the model to be estimated.

Table 1 - Definition and source of variables

Variable	Description	Source
IDE_{it}	Represents the share of Foreign Direct Investment in the GDP of country i in period t.	WDI
$Infl_{it}$	Represents the inflation rate, i.e. the consumer price index in country i in period t.	WDI
$Txpib_{it}$	Is the GDP growth rate of country i in period t.	WDI
Pop_{it}	Is the population growth rate of country i in period t.	WDI
Ouv_{it}	The degree of openness of the economy of country i in period t. It is given by the sum of exports and imports in value of goods and services in relation to GDP.	WDI
$Energy\_use_{it}$	Is the per capita non-renewable energy consumption of country i in period t.	WDI
$Energy\_ren_{it}$	Is the proportion of renewable energy consumed in the total energy of country i in period t.	WDI
$Cell_{it}$	Is the number of subscribers to telecommunications services in country i per 1000 inhabitants in period t ;	WDI
$Remittance_{it}$	Is the amount of remittances received in country i in period t as a percentage of GDP.	WDI

Source : Authors.

3.2. Estimation techniques

The dynamic specification expressed by the lagged variable of the growth rate of the panel model to be estimated and the taking into account of the interactions of the effects between the investments and the energy consumption causes a priori a problem of endogenization, double causality and/or multicollinearity of the variables. In order to overcome these difficulties, we choose to use the Generalized Moment Method (GMM).

We distinguish two types of GMM estimators for dynamic models on panel data, namely, the difference GMM estimator and the system GMM estimator. As Arellano and Bover (1995) and Blundell and Bond (1998) show, when the data are highly persistent and the number of periods is small, the difference GMM estimator provides poor estimates because under these conditions the level lagged variables are weak instruments. Blundell and Bond (1998) show the superiority of the system GMM estimator in this case. Thus, it seems more relevant to estimate our model with a system GMM estimator than with a difference MMG estimator because of the specificities of our sample. And so we will introduce lagged and non-lagged variables as instruments whose validity will be tested by Sargan and Hansen tests (Ongo, 2016).

4. Results and interpretation

The objective of this study is to examine the effects of renewable energy consumption on economic growth in SSA. However, it seems important to highlight the implications of nonrenewable energy consumption demand on economic growth. This exercise will allow a conclusion to be drawn later on as to the magnitude of renewable energy consumption on growth compared to non-renewable energy consumption. The results of the effects of oil consumption per capita or non-renewable energy are thus presented in Table 2.

Thus, the first observation to be made from this table is that an inflationary trend or an increase in the consumer price index in SSA has a significant negative impact on economic growth at the 5% threshold due to the deterioration in purchasing power. A one-point increase in the inflation rate reduces economic growth in SSA by 0.77 points.

An increase in population growth is not an opportunity to promote economic development. An increase in the annual population growth rate negatively and significantly affects economic growth at the 1% threshold. The results show that a 1% point increase in population growth reduces economic growth by 1.3%.

Trade openness in the context of SSA countries improves economic growth. A 1% increase in trade openness improves the growth rate by 0.034%. Improving trade openness implies an increase in trade, which has a positive impact on economic growth. In the wake of Nguyen and Toan (2021), trade openness makes it possible to promote sustainable growth without the need to add other underlying economic policies.

The effects of energy consumption as expected are not conclusive. It appears that despite an increase in per capita energy consumption, economic growth does not follow. This result is significant at the 5% level. Thus, an increase in per capita energy consumption in SSA marginally reduces economic growth by 0.004 points. Contrary to the findings of Gozgor et al. (2018), energy consumption for the case of OECD countries regardless of type is a source of economic development. However, the accessibility of the technologies may be an important condition for the expected effects. The contribution of the work of Aperghis and Payne (2012) on the question of the double causality of the relationship between growth and energy consumption on a sample of 80 countries helps to justify the present result. For these authors, there is a two-way causality between growth and energy consumption. Therefore, if energy consumption does not have a positive effect on growth, this may be due to the low level of economic development or the low level of growth. Unlike other works, Shahbaz et al. (2013) conclude that energy consumption is not only negatively correlated with economic growth in developing countries but the effect is insignificant. Moreover, this conclusion prevails only for non-renewable energy.

Migrant remittances do not positively affect economic growth in SSA. This result is significant at the 1% level; an increase in migrant remittances reduces economic growth by 0.28%. For most of the work, income from outside the country is an opportunity for recipients to access financial services (Tu et al., 2019). However, another view linked to the persistence of poverty in developing countries shows that remittances are used more for household consumption than for productive investment and therefore have no impact on economic development. It is in this logic that Chami et al. (2005) define remittances as a financial compensation for countries with a weak economic performance.

Table 3 - Effects of energy consumption on economic growth

	Txpib
L.txpib	0.151***
	(0.036)
Infl	-0.077***
	(0.029)
Pop	-1.393***
	(0.247)
Ouv	0.034*
	(0.018)
Energy_percapita	-0.004**
	(0.002)
Cell	-0.003
	(0.007)
Remittance	-0.286***
	(0.085)
_pictures	9.938***
	(1.254)
Observations	292
Instruments	21
Countries	22
AR(1)	0.003
AR(2)	0.574
Hansenp	0.423

Note: standard errors are in parentheses *** p<.01, ** p<.05, * p<.1

The consideration of the variable *energy consumed per capita* in the previous analyses provides an overall view of the implications of energy consumption on economic growth. The results given in Table 4 allow us first to distinguish the contribution of renewable energies to economic growth (1). Then to identify the implications of foreign direct investments (2) and finally to highlight the cross-effects of these investments on growth via the consumption of renewable energy (3) in SSA.

Controlling only for the effects of renewable energy consumption (1), FDI (2), and cross effects (3), the inflation rate is found to have a perverse effect on growth. An increase in the price level significantly reduces growth by at least 0.92 in all three phases of the estimates at the 1% threshold. However, the effects of inflation become less and less significant when controlling for FDI and its cross-over to renewable energy.

As obtained earlier, the effects of openness are always positive and significant on economic growth. A 1% increase in trade in national output increases economic growth by at least 0.034%. Unlike the previous case concerning the consumption of non-renewable energy, an increase in the demand or consumption of renewable energy of 1% improves the level of economic growth by 0.20%. This result is significant at the 1% threshold. In other words, energy consumption is a guarantee of economic development. For most of the results obtained in the demonstration of the renewable energy-growth relationship, the results remain positive, especially for developing economies. Despite the debate regarding the direction of causality between growth and renewable energy consumption (Salim and Rafiq, 2012; Aspergis and Danuletiu, 2014; Allam and Nader,

2021), the results of the work obtained in the case of SSA countries broadly corroborate a positive relationship between growth and energy consumption. Moreover, by comparing columns 2 and 3, it emerges that in the presence of FDI, the consumption of renewable energies provides a better boost to economic growth, at 0.28%. According to Gozgor et al (2018) the technological transition best conditions the effects of renewable energy consumption on economic growth. If, FDI is directed in the development of technologies related to the accessibility of renewable energy, economic growth can follow. Thus, the consumption of renewable energy cannot guarantee economic growth to the extent that FDI is directed to it. Despite the different transition periods of access to renewable energy in SSA, the effect remains very significant and high according to the coefficient obtained. In line with the recommendations of Khan et al. (2020), education in the consumption of renewable energies to the detriment of other types of energy (oil, gas, etc.) with a high impact on the environment remains recommendable. This is in order to guarantee not only economic growth but also to accompany the process of sustainable development.

Access to telecommunications services has a positive influence on economic growth. This can be explained by the importance of computer and telecommunications services in economic development. The increase in the number of subscribers to telecommunications services impacts growth by 0.028 points. In the presence of FDI (column 3), the effect increases marginally to 0.034 points as a result of increased access to telecommunication services. There are several channels to explain the effect of telecom services on growth. The GSMA report[5] (2019) showed that the digital ecosystem or telecom services contributed significantly and at 8% in GDP in SSA.

As for migrant remittances, they still have a negative impact on economic growth in SSA. For a 1% increase in remittances received, the estimated effects on growth are around 0.05%.

Moreover, the effects become more negative in the specific presence of FDI (column 2), so that they amount to 0.48%. The amount of transfers is not oriented towards the development of activities with a strong impact on growth despite the presence of FDI.

[5] Global Système Mobil Association.

Table 4 - Growth effects of renewable energy and foreign direct investment

	(1)	*(2)*	*(3)*
L.txpib	2.128***	-0.257***	2.259***
	(0.04)	(0.025)	(0.13)
Infl	-.192***	-0.076***	-0.053***
	(0.014)	(0.009)	(0.009)
Pop	0.389	-2.789***	-6.032***
	(0.276)	(0.379)	(0.374)
Ouv	0.034***	0.006	0.009
	(0.007)	(0.013)	(0.019)
Energy_ren	0.206***	-0.146	0.284***
	(0.023)	(0.107)	(0.044)
Cell	0.028***	-0.049***	0.034***
	(0.006)	(0.013)	(0.012)
Remittance	-0.059***	-0.486***	-0.003
	(0.017)	(0.069)	(0.068)
IDE		0.203**	-1.0977***
		(0.084)	(1.255)
*Energy_ren*IDE*			0.131***
			(0.015)
Cons	-22.965***	26.918***	-10.301**
	(2.37)	(8.394)	(4.408)
Observations	554	497	497
Instruments	27	29	28
Countries	30	30	30
AR(1)	0	0.009	0.001
AR(2)	0.101	0.361	0.03
Hansenp	0.6	0.97	0.552

Note: Standard errors are in parentheses *** p<.01, ** p<.05, * p<.1

FDI suggests mixed implications. First, controlling for its effects simultaneously with those of renewable energy, the results show that FDI significantly influences economic growth in SSA at the 5% threshold. An increase in FDI affects growth upwards by 0.2%. Then, in the case of the analysis of the transmission channel of the effects of FDI on growth by renewable energy (column 3), the impact is negative at 1.09% and significant at the 1% threshold. In addition, the cross-tabulation of FDI with renewable energy makes it possible to justify the fact that investments in access to renewable energy make it possible to guarantee and/or significantly improve economic growth at the 1% threshold. An increase in FDI promoting renewable energy consumption will affect economic growth by at least 0.13%. In other words, as a result of the cross effects, the growth process can only be maintained in the dynamic where a good part of the FDI is directed in financing renewable energies. The consumption of renewable energy alone cannot guarantee sustainable growth in SSA; likewise, FDI not directed into renewable energy will significantly reduce economic growth (column 3).

Tables 3 and 4 show that renewable energy consumption contributes positively to economic growth in SSA. This situation is more prevalent in the presence of FDI. Previously, our results have shown that the consumption of other types of energy in general (apart from renewable

energy) does not seem to guarantee economic growth despite their much advocated joint development (Deleuze, 2017).

Table 5 - Effects of energy consumption and FDI on growth

	Txpib
L.txpib	-0.552***
	(0.054)
Infl	-0.721*
	(0.395)
Pop	-9.137
	(6.691)
Ouv	0.05*
	(0.027)
Energy_percapita	0.013***
	(0.005)
IDE	2.844***
	(0.645)
*Energy_percapita*IDE*	-0.006***
	(0.001)
Cell	-0.144***
	(0.048)
Remittance	-0.826
	(0.506)
_pictures	34.932*
	(19.183)
Observations	265
Instruments	22
Countries	22
AR(1)	0.003
AR(2)	0.196
Hansenp	0.147

Note: standard errors are in parentheses *** p<.01, ** p<.05, * p<.1

Table 5 above tests the robustness of the FDI growth channel to the effects of non-renewable energy consumption. Consumption of non-renewable energy may not have the same implications as renewable energy. Comparing the results in Table 5 to Table 4, controlling for FDI in per capita energy and renewable energy consumption allows us to distinguish two effects. First, energy consumption per capita in general has a significant positive impact on economic growth in SSA. The same is true for renewable energy consumption. In addition, the effects of renewable energy consumption on economic growth are higher (estimated at 0.28%). Second, following the controls for the effects of renewable energy by FDI on economic growth, the implications are maintained in terms of positive effects. However, there is a decrease in the value of the coefficient, explained by heterogeneous levels of FDI or renewable energy transitions in SSA.

Taking into account per capita energy consumption in a global way leaves negative and very small effects despite the control of FDI.

5. Conclusion

The input used here to address the question of the effects of renewable energy consumption on economic growth through foreign direct investment in SSA is that of a linear growth function aimed at demonstrating the existence of causal links in a group of 30 SSA countries over the period 1997-2021. Thus, the tools of panel data econometrics were mobilized with an option for the dynamic panel system. While the empirical literature concludes that there is a positive double causality between energy consumption and economic growth, the case of the SSA countries studied shows mixed results. It appears that, apart from renewable energy, the consumption of other types of non-renewable energy does not positively affect growth.

The countries concerned seem to be victims of the threshold effect in terms of the supply of insufficient energy services to trigger any development of activities in energy-intensive sectors that generate higher GDP growth. These results confirm those found by Huang et al. (2008) who conclude that for low-income countries there is no causality between energy consumption and economic growth. This is why the FDI channel does not change this reality. In most SSA countries, FDI is oriented towards the exploitation of natural resources and therefore does not generate sufficient positive technological externalities as in endogenous growth models. This is because, in most cases, the skilled labor used in this sector is imported from outside. In addition, the system put in place by these industries does not often encourage the training of a local workforce that can take over. It also appears that the consumption of renewable energy has a positive impact on economic growth. Consequently, raising awareness among the population to change their individual behavior in terms of renewable energy consumption remains an important point in the search for energy efficiency.

Finally, public policies should direct FDI towards renewable energies because the potential really exists in SSA, especially in solar energy. Further studies will consist to estimate the effect of different existent renewable energy on economic growth and especially the sectors of activity with high-energy intensity in order to better involve the financial sector in the mobilization of the necessary resources for the indispensable investments.

References

Alper A, Oguz O (2016). The role of renewable energy consumption in economic growth: Evidence from asymmetric causality. *Renewable and Sustainable Energy Reviews*. 60: 953-959.

Apergis N, Payne J A (2012). Renewable and non-renewable energy consumption-growth nexus: Evidence from a panel error correction model. *Energy Economics*. 34(3): 733-8.

Arellano M, Bover O (1995). Another look at the instrumental variable estimation of errorcomponents models. *Journal of Econometrics*. 68: 29-51.

Aspergis N, Danuletiu D C (2014). Renewable Energy and Ecomic growth: Evidence from the sign of panel long-run causality. *International Journal of Energy Economics and Policy*. 4(4): 578-587.

Aspergis N, Payne J A (2010). Renewable energy consumption and economic growth: Evidence from a panel of OECD countries. *Energy Policy*. 38:656-660.

Bhuiyan M A, Zhang Q, Kave V, Mikhaylov A, Pinter G, Huang X (2022). Renewable Energy Consumption and Economic Growth Nexus - A Systemic literature review. *Frontiers in Environmental Science,* http://doi.org/10.3389./fenv.2022.878394

Blundell R, Bond S (1998). Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *Journal of Econometrics*. 87: 115-143.

Bouyghrissi S, Berjaoui A, Khanniba M (2021). The nexus between renewable energy consumption and economic growth in Morocco. *Environmental Science* and *Pollution Research,* 28(5): 5693-5703.

Broensztein E, De Gregorio J, Lee W (1998). How does direct investment affect economic growth? *Journal of international Economics*. 45(1): 115-135.

Canning D, Pedroni P (2008). Infrastructure, long-run economic growth and causality tests for cointegrated panels. *The Manchester School*. 76(5): 504-527.

Chami R, Fullenkamp C (2012). Worker's remittances and economic development: realities and possibilities, in maximizing the development impact of remittances. *New York: United Nations Conference on Trade and Development.*

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

Davidson N, Maksimova E, Mariev O (2021). How does renewable energy consumption affect economic growth? Evidence from the European Union countries. https://doi.org/10.1051/shsconf/202112909005

Destek M A (2016). Renewable energy consumption and economic growth in newly industrialized countries: evidence from asymmetric causality test. *Renewable Energy.*95: 478-484.

Eyuboglu K, Uzar U (2022). Asymmetric causality between renewable energy consumption and economic growth: fresh evidence from some emerging countries. *Environmental Science and Pollution Research*. 29: 21899-21911.

Gozgor G, Marco Lau CK, Lu Z (2018). Energy consumption and economic growth: New evidence from the OECD countries. *Energy*. 153(C): 27-34.

GSMA (2019). The Mobile Economy in Sub-Saharan Africa. Report. Available at www.gsmaintelligence.com

Huang B-N, Hwang M J, Yang C W (2008). Causal relationship between energy consumption and GDP growth revisited: A dynamic panel data approach. *Ecological Economics*. 67: 41-54.

Inglesi-Lotz R (2016). The impact of renewable energy consumption to economic growth: A panel data application. *Energy Economics*. 53: 58-63.

IRENA (2021). Renewable energy highlights. Rapport available at : https://www.irena.org/publications/2021/Aug/Renewable-energy-statistics-2021

Kaspercwicz R, Bilan Y, Streimikiené D (2020). The renewable energy and economic growth nexus in European countries. *Sustainable Development*. 28(5): 1086-1093.

Khan M K, Khan M I, Rehan M (2020). The relationship between energy consumption, economic growth and carbon dioxide emissions in Pakistan. *Financial Innovation*. 6(1), https://doi.org/10.1186/s40854-019-0162-0

Koç M, Kiymaz Kivraklav M, Mert N (2022). Nexus between renewable Energy Consumption, Financial Development and Economic Growth: Evidence from IEA countries. Erciyes Akademi, 36(2), 632-656. https://doi.org/10.48070/erciyesakademi.1089386

Konya L (2006). Exports and growth: Granger causality analysis on OECD countries with a panel data approach. *Economic Modelling*. 23(6): 978-992.

Madj A, Nader R B (2021). The relation between renewable Energy Consumption and Economic growth: The case of 3 Mediterranean countries. *South Florida Journal of Development*. 2: 5776-5786.

Marouane A, Nicet-Chenaf D, Rougier E (2009). Under what conditions does FDI stimulate growth? *Mondes en Developpement* Vol. 37 n° 148.

Nguyen M T, Toan N B (2021). Trade Openness and Economic Growth: A Study on Asean-6. *Economics*. 9: 113.

Omri A, Kahouli B (2013). Causal relationships between energy consumption, foreign direct investment and economic growth: fresh evidence from dynamic simultaneous-equations models. *Energy Policy*. https://dx.doi.org/10.1616/j.enpol.1013.11.067

Ongo Nkoa B E (2016). Foreign direct investment and Africa's industrialization: a new look. *Innovations*. 51: 173-196.

Salim R A, Rafiq S (2012). Why do some emerging economies proactively accelerate the adoption of renewable energy? *Energy Economics*. 34(4): 1051-1057.

Shahbaz M, Solarin S A, Mahmood H, Arouri M (2013). Does financial development reduce CO2 emissions in Malaysian economy? A time series analysis. *Economic Modelling*. 35: 145152

Tu CA, Nguyet TMP, Le Quoc T, Naoyuki Y, Tapan S, Farhad T-H (2019). Remittance inflows, financial inclusion, and economic development: an empirical analysis of the world sample. *ADBI Working Paper Series*. 1000.