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Natural resources governance and sustainable development: a curse or blessing for resource abundant economies?

[1,]Samia Gmidène , [2,]Saida Zaidi, [3,]Sonia Zouari Ghorbel

ABSTRACT: *This paper investigates the impact of renewable energy, nonrenewable energy consumption and governance, together with other economic, social and environmental factors, on sustainable development in Sub-Saharan resource-rich countries from 1990 to 2015, using static panel (POLS, FE and RE) and dynamic panel (GMM-DIFF and GMM-SYS). Results indicate that environment damages have negative impact on human development. In addition, corruption, political instability and population negatively affect human development and environment performance. These results show that resources in Sub-Saharan resource-rich countries are a curse more than blessings. Quality of institutions and other governance indicators are likely to be weak in promoting economic, social and environment development. Ensuring sustainable development and overcoming resource rents requires not only solid institutional quality, transparency and higher degree of economic and social freedom, but also rationalizing nonrenewable energy consumption and developing renewable energy technologies nature friendly.*

KEYWORDS: *Sub-Saharan resource-rich countries, resource curse, economic development, social development, environment development, GMM estimation*

I. INTRODUCTION

Modern economic development as we know it today, from the process of industrialization of the last two centuries, feeds primarily on non-renewable mineral resources extracted from the lithosphere (crust). It enjoys a relatively abundant and cheap energy from fossil fuels - oil, natural gas and coal - and to a lesser extent fissile material such as uranium. Other energy sources, so-called traditional, such as biomass, wind or hydro, were marginalized in the "energy mix" of industrialized countries (Knight 2004). Sustainable development means to meet the needs of the present, without compromising the ability of future generations to meet their own needs." The International Monetary Fund (IMF) defines a country to be 'resource-rich', when exports of non-renewable natural resources such as oil, minerals and metals account for more than 25 % of the value of the country's total exports. These countries are endowed with immense natural and human resources as well as great cultural, ecological and economic diversity, remains underdeveloped. Most less developed countries suffer from military dictatorships, corruption, civil unrest and war, underdevelopment and deep poverty. The majority of them classified by the UN are in Africa. Numerous development strategies have failed to yield the expected results. Although some believe that the continent is doomed to everlasting poverty and economic slavery, Africa has immense potential. Countries selected in this study are the resource rich Sub-Saharan Africa (SSA hereafter).

IMF has classified low income countries in Sub-Saharan Africa as being resource-rich. This classification was based on data from 2005-2010, and included Angola, Equatorial Guinea, Congo Dem. Rep., Nigeria, Guinea, Gabon, Congo Rep., Chad, Botswana, Zambia, Sierra Leone, Mali, Namibia, Niger, Cameroon, Zimbabwe, Tanzania, Ghana, Central African Republic and South Africa5 . Based on the IMF definition, our analysis of data from 2012 and 2013 demonstrates that seven new countries can be classified as resource-rich countries today. The additional countries are the Ivory Coast (Côte d'Ivoire), Mauritania, Liberia, Burkina Faso, Sudan, South Sudan and Mozambique. In addition, four SSA countries have prospects of becoming resource-rich in the nearby future. Whereas Uganda recently has begun exploration of oil, Kenya and Madagascar are still in the exploration phase.7 Malawi is expanding their extractive industries rapidly with exploration of oil, uranium and coal. Unlike other papers, this study integrates renewable energy consumption as independent variable and uses dynamic simultaneous equations to examine the relationship between pillars of sustainable development. The updated mapping of resource-rich SSA countries illustrates the increasing importance of and dependency on the extractive industry. However, many SSA resource-rich countries have been unable to translate the resource wealth into inclusive social development. Potential tax revenues tend to evaporate as a result of generous tax breaks granted by governments and aggressive tax planning by multinational corporations. Moreover, corruption, ineffective governance systems and the existence of a global web of tax havens are additional barriers preventing revenues from natural resources from benefitting the vast population in SSA. Governments, civil society and the private sector should jointly work towards (i) improved policies and enforcement of legal frameworks governing the extractive industries, (ii) more transparent and accountable management of revenues, and (iii) efficient and democratic redistribution of revenues benefitting all parts of society. These three steps could assist SSA countries in turning natural resource wealth into inclusive social development, which would benefit all stakeholders. To our knowledge, unlike previous studies, this paper integrates renewable energy sources and governance indicators in the sustainable development process. The rest of paper is organized as follows: after introduction which is presented in Section 1 above, Section 2 presents the material and methods, Section 3 reports the obtained and provides detailed discussions, and final Section concludes the study and offers some policy implications.

Table 1 Summary of conducted studies on adjusted net savings

Authors	Objectives	Data	Results
Atkinson et Hamilton (2003)	Study the natural resources	Examine the resource curse with ANS	The resource curse is associated with low levels of ANS
Dietz et al (2004)	Impact of institutions on ANS	90-118 countries from 1970 to 2001. World Bank data (2003)	Corruption reduces ANS levels
Ferreira et Vincent (2005)	ANS test	93 countries pooling with horizons of 10, 20 years from 1971 to 2000	ANS does not pass the test
Neumayer (2003)	Examine the resource curse with ANS as alternative of income as a criterion of assessment	20 resource rich countries over 1970-1998. . World Bank data (2003)	The results mitigate the resource curse but support the idea that it would be due to underinvestment
Pillarisetti (2005)	Conceptual criticism, (descriptive statistics)	122 countries, 1999 excepted for carbon emissions (1998). Source: WDI (2001) and Reports on Human Development (UNDP, 2000, 2001, 2002)	The policy implications are wrong: ANS is based on the weak sustainability and the data depend heavily on the education component.
Atkinson et Hamilton (2007)	Assessment of progress in the measures of the ANS: measures reductions of exhaustible resources and environmental degradation	21 oil-producing countries for the NAS data, 2000. The data on prices and reduce oil inventories are from the WDI, World Bank (2005)	The assessments are imperfect and still progress to make
Ferreira et al. (2008)	Test ANS taking into account the growth of the population	Panel data, 64 developing countries, 1970-82	Positive and significant impact of ENA
G. Carbonnier, N. Wagner (2012)	resource dependence and sustainable development, and look at specific governance and armed violence indicators	Dynamic panel data of 96 developing countries over 24 years, from 1984 to 2007.	Low levels of ANS explained by armed conflict and armed violence as measured by the homicide rate

There are few studies that investigated the impact of both renewable energy, non renewable energy consumption on HDI. Kazar et al (2014) investigated the relationship between renewable electricity net generation values and development. Their study covered two different time periods: 1980-2010 with 5-year data to analyze long term effects and 2005-2010 yearly data for short term effects. They found in short run, exists a bidirectional relationship between renewable energy production and economic development as measured by HDI. In the long run, they found that causal relationship between economic development and renewable energy production varies both in the long run and in the short run due to human development level of the countries. EPI, ANS and HDI. The link between natural resources and EPI was investigated by Shahabadi (2016) et al. for oil a panel of oil exporters' countries from 1996 to 2002. They integrated the foreign direct investment and governance indicators. Their results show that results good governance indicators and natural resources are the key determinants of FDI inflows. As well as Foreign direct investment leading to improve the environment performance in developed countries. Because in these countries, unlike selected oil countries, there are laws preventing.

II. DATA AND METHODS

This paper attempts to study the causal relationship between renewable energy, non-renewable energy consumption and governance, together with other economic, social and environmental factors, on sustainable development in Sub-Saharan resource-rich countries over the period 1990-2013, using static panel (POLS, FE and RE) and dynamic panel (GMM-DIFF and GMM-SYS).

Model specification: Pearce and Atkinson (1993) produced initial GS estimates for 18 countries. Since then, the GS mantle has very much been assumed by the World Bank (see, for example, World Bank 2003), which now regularly publishes a comparatively comprehensive GS measurement exercise for over 163 countries.

- Measure of adjusted net savings: The World Bank operationalises GS, which it now calls 'Net Adjusted Savings as follows:

$$ANS_{it} = GS_{it} + DEPC_{it} + EE_{it} + RRD_{it} + CD_{it}$$

Where,

ANS, adjusted net savings, *GS*: genuine savings, *DEPC*: capital depreciation, *CD*:, consumption of fixed capital , *EE* : education expenditure

- Measure of modified human development index: this index was defined by the UNDP (United Nations Development Program)

$$IDHM = \frac{1}{2}\,(indice\ d'espérancede\ vie\ à\ la\ naissance + indice\ de\ l'éducation)$$

The general form to measure this composite index is: $\frac{actual\ value - minimum\ value}{maximum\ value - minimum\ value}$

$$HDI = \frac{LEB + EDU + GDP/cap}{3}$$

LEB: life expectancy at birth
EDU: education level = 2/3 literacy indicator+1/3 scolorization indicator
GDP/cap: per capita Gross Domestic Product
In order to avoid the problem of multicolinearity, we used modified human development index as measured by the UN. It takes the same strategy in measuring the HDI,

- Measure of the Environmental Performance Index (EPI) The EPI is based on a proximity-to-target approach which measures country performance against an absolute target established by international agreements, national standards, or scientific consensus (Esty, 2006, p. 275). All variables are normalized in a scale from zero to 100. The maximum value of 100 is linked to the target, the minimum value of zero characterizes the worst competitor in the field. The Environmental Performance Index (EPI), based at Yale University has launched its 2016 report at the World Economic Forum in Davos, Switzerland, highlighting new data and indicators on high-priority environmental issues. The EPI's authors argue that aligning the EPI's indicators with the SDGs can provide a baseline for evaluating national performance and help show how far countries are from reaching global targets.

The EPI brings extensive new data and analysis to bear in ranking countries' performance on high-priority environmental issues in two areas: protection of human health and protection of ecosystems. Within these two policy objectives the EPI scores national performance in nine issue areas comprised of more than 20 indicators. EPI indicators measure country proximity to meeting internationally established targets or, in the absence of agreed targets, how nations compare to one another.
Using the production function. The general form of this function is presented as follows:

$$Y^{\alpha it} A K^{\alpha} L^{ß}$$

Whereα represents a constant; b, c and d are the exponents of A, K and L, which indicates, respectively, technology elasticity; capital elasticity and labor elasticitye is the error term; and t denotes the year. The subscript i illustrates the differences between the quantities Y, A, K, and L and e across observational units. In this paper, three different models are used to estimate the effects of different variables on ANS, HDI and EPI.

(1) $ANS_{it} = \beta_0+\beta_1 ANS_{i,t-1}+\beta_2 GDP_{i,t-1}+\beta_3 REN_{it}+\beta_4 NRN_{it} + \beta_5 POP_{it}+\beta_6 RR_{it}+\beta_7 GOV_{it}+\beta_8 HDI_{it}+\beta_9 HER_{it} + \lambda_{it}+\nu_{it}+\varepsilon_{it}$

(2) $HDI_{it} = \beta_0+\beta_1 HDI_{i,t-1}+\beta_2 GDP_{i,t-1}+\beta_3 REN_{it}+\beta_4 NRN_{it} + \beta_5 POP_{it}+\beta_6 RR_{it}+\beta_7 GOV_{it}+\beta_9 HER_{it} + \lambda_{it}+\nu_{it}+\varepsilon_{it}$

(3) $EPI_{it} = \beta_0+\beta_1 EPI_{i,t-1}+\beta_2 GDP_{i,t-1}+\beta_3 REN_{it}+\beta_4 NRN_{it} + \beta_5 POP_{it}+\beta_6 RR_{it}+\beta_7 GOV_{it}+\beta_8 HDI_{it}+\beta_9 HER_{it} + \lambda_{it}+\nu_{it}+\varepsilon_{it}$

Equation (1) Acoording to Garbonnier et al (2012) and Metis et al (2013), resources richness, governance indicators are key determinants of Ajusted Net Savings. They found negative relationship between natural resources extraction and ANS. For resource rich countries, they found a negative relationship between natural resource exraction and ANS but indicate that this is not inevitable. Also, governance indicators as studied by SIMON DIETZ and ERIC NEUMAYER (2007). They argue that institutional failure that depresses growth – to data on genuine saving. They regress gross and genuine saving on three indicators of institutional quality in interaction with an indicator of resource abundance. The indicators of institutional quality are corruption, bureaucratic quality and the rule of law. We find that reducing corruption has a positive impact on genuine saving in interaction with resource abundance. That is, the negative effect of resource abundance on genuine saving is reduced as corruption is reduced. Equation (2) Jarita Duasa and Rafia Afroz (2013) used renewable energy and non renewable energy sources and other factors as key determinants of human development. Corina Pîrlogea (2012) used both renewable and non renewable energy consumptions are included in the analysis in order to declare their capability of attaining human development in the context of consequences on health and environment. In the same time, as energy consumption is accompanied by carbon emissions, they included the CO2 intensity among the explanatory variables. Equation (3) derives the impact of renewable energy and non renewable energy consumption and other factors on environmenet quality as measured by the EPI. Norma Maccari

Logarithmic transformation gives:

$$lnANS_{it} = \beta_0+\beta_1 lnANS_{i,t-1}+\beta_2 lnGDP_{i,t-1}+\beta_3 lnREN_{it}+\beta_4 lnNRN_{it} + \beta_5 lnPOP_{it}+\beta_6 lnRR_{it}+\beta_7 lnGOV_{it}+\beta_8 lnHDI_{it}+\beta_9 lnHER_{it} + \lambda_{it}+\nu_{it}+\varepsilon_{it}$$

$$lnHDI_{it} = \beta_0+\beta_1 lnHDI_{i,t-1}+\beta_2 lnGDP_{i,t-1}+\beta_3 lnREN_{it}+\beta_4 lnNRN_{it} + \beta_5 lnPOP_{it}+\beta_6 lnRR_{it}+\beta_7 lnGOV_{it}+\beta_{9ln} HER_{it} + \lambda_{it}+\nu_{it}+\varepsilon_{it}$$

$$EPI_{it} = \beta_0+\beta_1 EPI_{i,t-1}+\beta_2 GDP_{i,t-1}+\beta_3 REN_{it}+\beta_4 NRN_{it} + \beta_5 POP_{it}+\beta_6 RR_{it}+\beta_7 GOV_{it}+\beta_8 HDI_{it}+\beta_9 HER_{it} + \lambda_{it}+\nu_{it}+\varepsilon_{it}$$

Following Maccari et el (2014), the modified environment Kuznets Curve is defined by:

$$EPI=\alpha+\beta HDI+\gamma HDI^2$$

Where, EPI is environmental performance index and MHDI is modified human development index

III. RESULTS AND DISCUSSION

The aim of this study is to examine the impact of renewable and nonrenewable energy consumption on ANS, HDI and EPI using both static and dynamic panel data methods for 17 low income countries' over the period from 1990 to 2013. The results of the two methods are given in Table 3 and 4.

Panel unit root test result: Applying unit root test on time series have become commonplace in empirical economics, while recently, this test is applied on panel data. The raison is that panel unit root test is more powerful compared to unit root test for time series. Levin, Lin and Chu (LLC) (2002) and Im, Pesaran and Shin (IPS) (2003), among others, are the well-know. LLC is based on the assumption of homogeneity in the dynamics of the autoregressive coefficients for all members of panel, in contrary to IPS, test that allows their heterogeneity. So, when imposing uniform lag length is not appropriate, it is particularly reasonable to allow for such heterogeneity in choosing the lag length in ADF tests. Furthermore, when using cross-country, slope heterogeneity is more suitable. Hence, differences in economic conditions and degree of development of each country, allows the heterogeneity. Levin et al. (2002) set up that panel approach increases considerably in finite samples when compared with the single-equation ADF test. They also proposed a panel based version that restricts $ß_i$ by keeping it identical across cross-countries as follows:

$$\Delta y_{it} = \alpha_i + ß\Delta y_{i,t-1} + \sum_{j=1}^{p_i} \mu_{i,j}\Delta y_{i,t-1}\, \varepsilon_{it}$$

Under the assumption:

H_0 : $ß_1 = ß_2 = ß = 0$

H_1 : $ß_1 = ß_2 = ß < 0$

The test is based on $v_ß = \frac{ß}{\sigma(ß)}$, ß is the OLS estimation of ß and σ(ß) is standard error

The basic ADF specification of Levin et al. (2002):

$$\Delta y_{it} = \alpha_i + ß_i\Delta y_{i,t-1} + \sum_{j=1}^{p_i} \mu_{i,j}\Delta y_{i,t-1}\, \varepsilon_{it}$$

Where yi,t (i=1, 2,…..,N; t=1,2,…….,T) designates panel number series (country) i in t, µi is lag number in the ADF reg σ_i^2ression, and ε_{it} the error terms is a white-noise distributed with a variance of. Both $ß_i$ and the lag order µ are permitted to vary across sections (countries). Hence, they assumed

$ß_i = 0$

$ß_i < 0$, where the stationary $Y_{i,t}$ is the alternative hypothesis

Im et al. (2003) tested a procedure based on the mean group approach. The IPS test is also based on the ADF

regressions. But, assumes the rejection of the null hypothesis that all the series are stationary. So,

bar $\frac{\sum_{i=1}^{N} vß_i}{N}$

where v is the calculated ADF statistics from individual panel members. Using Monte Carlo simulations, IPS assumes the null hypothesis that the v-bar (*t*) is normally distributed and S-bar are outperformed into small samples. Im et al. (2003) estimated its mean and its variance to convert (*v*) into a standard normal w-bar (*w*). Hence, its significance is evaluated using statistic so that conventional critical values. The staitistc test of (*w*) is given by the following equation:

$$w \frac{\sqrt{N}(v - E[v\backslash ß_i = 0])}{\sqrt{var\ [v\backslash ß_i = 0]})}, N(0,1)$$

Where *v* is as defined before, $(E[v\backslash ß_i = 0])$ and var $([v\backslash ß_i = 0])$ are the mean and variance of v_{it} given by the simulations of Monte Carlo with i= 1,2,…,N.

H_0 : $ß_1 = ß_2 = ß_n = 0$

H_1 : $ß_1 = ß_2 = ß_n < 0$, it is not required for all $ß_n$

H0: β1 = β 2 = … = β N = 0 vs. H1: Some but not necessarily all β i 0 IPS developed two test statistics and called them the LM-bar and the t-bar tests. The tbar statistics is calculated using the average t-statistics for I from the separate ADF regressions in the following fashion:

This paper uses LLC and IPS unit root tests to test for stationarity of the panel data obtained for the sample.

Table 4 reports the results of panel unit root tests from LLC, IPS, Hadri, Maddala &Wu and Hadri for the level and first differenced series.

For all the three variables in level form, the null hypothesis of unit root cannot be rejected for the IPS, LLC tests, Breitung and Maddala &Wu; but the Hadri test rejects the null hypothesis at the 1% significance level for all the variables in level form.

Table 3: panel unit root test results

		Ho : tout les panels contiennent une racin unitaire			
		IDH moyen			
	Variables	**LLC**		**IPS**	
Panel		**Constant**	**Constant+trend**	**Constant**	**Constant+trend**
Niveau	**ANS**	-0.3385 (0.3657)	**-1.9208 (0.0274)**	-0.0221 (0.4912)	**-2.0920 (0.0182)**
	CORR	**-2.1497 (0.0159)**	**-3.4343 (0.0003)**	**-1.7793 (0.0383)**	**-3.8945 (0.0.000)**
	NEPI	1.6680 (0.9523)	2.9495 (0.9984)	3.6805 (0.9999)	2.3915 (0.9916)
	GOVIND	**-1.9205 (0.0274)**	**-1.3488 (0.0887)**	2.4665 (0 .9932)	0.3436 (0.6344)
	HER	**-1.9206 (0.0274)**	**-1.3409 (0.0887)**	2.46666 (0.9932)	0.3433 (0.6343)
	IDHM	**-4.1646 (0.0000)**	**-4.3711 (0.0000)**	5.1279 (1.0000)	**-3.2911 (0.0003)**
	POLI	-0.5578 (0.2885)	0.0082 (0.5034)	5.1297 (1.0000)	1.6212 (0.9475)
	QUALI	**-3.6402 (0.0001)**	**-3.8181 (0.0001)**	-1.6064 (0.0543)	1.1609 (0.8772)
	RR	-0.7154 (0.2372)	**-2.3078 (0.0105)**	-1.6046 (0.0543)	1.1609 (0.8772)
	ROLEOFLO	**-1.4734 (0.0703)**	**-2.6613 (0.0039)**	-1.1565 (0.1237)	**-2.6645 (0.0039)**
Première différence	**ANS**	**-11.1283 (0.0000)**	**-8.69898 (0.0000)**	**-14.1566 (0.0000)**	**-12.7557 (0.0000)**
	CORR	**-11.9544 (0.0000)**	**-11.4557 (0.0000)**	**-13.2901 (0.0000)**	**-11.4892 (0.0000)**
	NEPI	**-8.3461 (0.0000)**	**-7.6395 (0.0000)**	**-9 .3811 (0.0000)**	**-7.8880 (0.0000)**
	GOVIND	**-9.5319 (0.0000)**	**-8.8390 (0.0000)**	**-9.3299 (0.0000)**	**-8.8065 (0.0000)**
	HER	**-9.5321 (0.0000)**	**-8.8390 (0.0000)**	**-9.3301 (0.0000)**	**-8.8067 (0.0000)**
	IDHM	**-11.3185 (0.0000)**	**-9.8084 (0.0000)**	**-12.2044 (0.0000)**	**-10.7295 (0.0000)**
	POLI	**-7.5455 (0.0000)**	**-4.2461 (0.0000)**	**-4.1486 (0.0000)**	**-8.6669 (0.0000)**
	QUALI	**-10.7601 (0.0000)**	**-9.6326 (0.0000)**	**-9.6757 (0.0000)**	**-7.8533 (0.0000)**
	RR	**-12.3339 (0.0000)**	**-10.8332 (0.0000)**	**-12.3561 (0.0000)**	**-10.5372 (0.0000)**
	ROLEOFLO	**-7.6884 (0.0000)**	**-4.5296 (0.0000)**	**-13.2195 (0.0000)**	**-11.0308 (0.0000)**
	FDVP	**-8.6059 (0.0000)**	**-7.8887 (0.0000)**	**-9.6105 (0.0000)**	**-7.9392 (0.0000)**

Static panel estimation results: Static panel estimation results are reported in table 4. Dynamic panel estimation to examine the impact of natural resources and other governance indicators on ANS, EPI and HDI for selected low income countries, we mull over a set of static panel estimation techniques including cross-section pooled Ordinary Least Squares (POLS), Fixed Effects and Random Effects (RE) models. To decide between cross-section

POLS and RE model, we use the Breusch–Pagan Lagrange Multiplier (LM) test to examine the null hypothesis that there are no random effects. This hypothesis, if accepted, would imply that cross-section POLS technique is more efficient than others. Also, we use the Hausman test in order to choose between FE and RE model specification test. The null hypothesis supposes that random effects are consistent and efficient. In the same way, if this hypothesis is rejected, then the estimation results provided by FE model are found to more appropriate (Tang and Aosedra, 2014).

Consequently, the null hypothesis of no random effect based on Breusch–Pagan LM test was rejected, implying that the estimation results with RE model are more robust than POLS. Then, the statistic of Hausman specification test proves to reject the null hypothesis and indicates that FE model is appropriate and more efficient. The FE model shows that resource rent, population, corruption quality of institutions, political stability has significant but positive effect on adjusted net savings. A 1% decrease in resource rent, population, corruption, quality of institutions and political stability depreciate natural capital by 0.45%, 0.38%, 0.43%, 0.54%, and 0.17% respectively. These results are consistent with Huang et al (2013). Thus, renewable energy consumption has significant and positive impact on adjusted net savings. The magnitude of 1% of renewable energy consumption increases adjusted net savings by 0.23%. These results are online with

With regards to the EPI, results show that human development index, resource endowment, political stability, quality of institutions has negative and significant effect on environment quality. A 1% increase in human development index, resource endowment, political stability, quality of institutions damages the environment by 27%, 5%, 8%, and 6% respectively. These results indicate the presence of environment Kuznets Curve for these countries.

Accordingly, renewable energy sources have positive and significant effect on HDI. A 1% increase in renewable energy consumption increases HDI by 1%. These results confirm those of hence, economic growth, bureaucracy, political stability, quality of institutions, and economic freedom While estimating the two-way linkages between nuclear (renewable) energy consumption and economic growth, K, L, CO2, OP, and OC are used as instrumental variables. The Durbin-Wu-Hausman test was used to test for endogeneity. The null hypothesis of the DWH endogeneity test is that an ordinary least squares (OLS) estimator of the same equation would yield consistent estimates: that is, an endogeneity among the regressors would not have deleterious effects on OLS estimates. A rejection of the null indicates that endogenous regressors' effects on the estimates are meaningful, and instrumental variables techniques are required. In addition, the validity of the instruments is tested using Hansen test which cannot reject the null hypothesis of overidentifying restrictions. That is, the null hypothesis that the instruments are appropriate cannot be rejected. Based on the sys-GMM estimation, we find that one period lagged value of GDP has a positive and significant impact on its current value 1% level. The result is in line with Omri et al. (2014). Renewable energy consumption has significant impact on sustainable human development. a 1% increase in renewable energy consumption increases SHDI by 0.005%. EPI and corruption have negative and significant impact on SHDI. . a 1% increase in EPI and corruption deceases SHDI by 0.008%.

Bureau and pop have positive and significant impact on EPI in 1% significance. A 1% increase in bureau and pop increase EPI by 0.22 and 0.08% respectively.

Table 4: static panel results

	Static panel								
	ANS			EPI			MHDI		
	POLS	FE	RE	POLS	FE	RE	POLS	FE	RE
REN	0.2005 (0.031)**	0.2306 (0.059)	0.2638 (0.192)	0.0233 (0.000)	-0.2694 (0.510)	0.0053 (0.050)**	0.0564 (0.000)	0.0100 (0.050)	-0.0212 (0.000)
NRN	-0.0200 (0.000)**	-0.0192 (0.963)	0.1084 (0.000)***	-0.0592 (0.000)	0.0026 (0.360)	0.0027 (0.606)	-0.0163 (0.389)	-0.0081 (0.606)	0.0054 (0.212)
GDP	0.04115 (0.034)**	0.0206 (0.308)	0.0602 (0.000)***	-0.0213 (0.274)	-0.0213 (0.274)	-0.0853 (0.000)	-0.0243 (0.738)	-0.1143 (0.075)	-0.5571 (0.000)
HDI	0.4379 (0.618)	0.2565 (0.919)	0.2723 (0.809)	-0.0171 (0.000)***	-0.2732 (0.000)***	-0.1535 (0.000)***	-	-	-
HDI²	-	-	-	0.0179 (0.000)***	0.0286 (0.000)***	0.0030 (0.000)***	-	-	-
BUREA	-0.0375 (0.142)	-0.0126 (0.910)	-0.0710 (0.151)	-0.033 (0. 140)	0.0226 (0.130)	0.0286 (0.123)	-0.1806 (0.009)	-0.1465 (0.000)	-1557 (0.000)
RR	-0.4583 (0.002)***	-0.0105 (0.062)	-0.0100 (0.035)**	0.0099 (0.000)***	-0.0051 (0.000)***	-0.0033 (0.000)	0.0044 (0.000)	0.0022 (0.679)	0.0023 (0.333)
POP	-0.3857 (0.000)***	-0.2811 (0.003)**	-0.2598 (0.000)***	0.0496 (0.000)	0.0880 (0.000)	0.0626 (0.000)	0.0023 (0.458)	0.0305 (0.100)	0.0960 (0.230)
POLI	-0.1738 (0.000)***	-0 .1505 (0.010)*	-0 .1245 (0.008)*	-0 .0828 (0.000)***	-0.0293 (0.001)	0 .0859 (0.172)	-0.22363 (0.000)	-0 .2859 (0.000)	0.25200 (0.000)
CORR	-0.4307 (0.017)	-0.7552 (0.017)	0.0240 (0.704)	-0.0707 (0.000)***	0.0244 (0.200)	0.0024 (0.362)	-0.0332 (0.633)	0.0024 (0.362)	-0.1001 (0.001)
Quality	-0.5426 (0.001)***	-0.4030 (0.002)***	-0 .2154 (0.000)***	-0.2287 (0.123)	-0.0680 (0.000)***	-0.0889 (0.000)***	0.0662 (0.006)	-0.0889 (0.000)	0.0107 (0.757)
FREE	-0.2884 (0.598)	-0.25671 (0.180)	-0.2140 (0.000)***	0.8443 (0.000)	0.0014 (0.951)	0.0012 (0.956)	-0.0195 (0.000)	-0.1664 (0.052)	-0.1799 (0.035)
Price	0.3488 (0.004)	0.3794 (0.270)	0.3920 (0.927)	-0.1535 (0.000)	-0.1060 (0.100)	-0.1074 (0.201)	-0.1232 (0.000)	-0.1074 (0.001)	-0.0908 (0.000)
C	33.5937 (0.000)***	-37.3081 (0.072)*	32.4981 (0.000)***	-3.1535 (0.000)***	-1.2598 (0.000)	-0.1074 (0.201)	-0.3778 (0.183)	-0.1074 (0.201)	-0 .7173 (0.000)
R²	0.63	0.60	0.62						
Bp test p-	226.27 (0.000)***			28.07 (0.000)***			83.43 (0.000)***		
Hausm p-value			53.10 (0.000)***			40.30 (0.000)***			34.45 (0.000)***
N.0	209								
N. C	17								

Notes: Values in parenthesis are the estimated p-values. Hansen J-test refers to the over-identification test for the restrictions in GMM estimation. DWH-test is the Durbin–Wu–Hausman test forendogeneity. *, **, and *** indicate significance at the 1%, 5%, and 10% levels, respectively.

Dynamic panel estimation results: In this study, we also have a dynamic panel specification where lagged levels of economic growth are taken into account by using both diff- and Sys-GMM estimators. Consistency of the GMM estimator depends on the validity of instruments. To address this issue, we consider two specification tests: the first is the Hansen test of over-identifying restrictions, which tests the overall validity of the instruments (the null is that the instruments are valid); second is the second-order autocorrelation test for error term, which tests the null according to which there is no autocorrelation. Table 2 shows that the Hansen test for diff-GMM estimation rejects the null hypothesis of over-identifying restrictions. Therefore, we conclude that the diff-GMM estimation may not be suitable in this context and we proceed to estimate our dynamic model using the sys-GMM estimator wherein both specification tests indicate that the used instruments are valid. Accordingly, we can conclude that the sys-GMM estimation is robust and appropriate. Based on the sys-GMM estimation, we find that one period lagged value of GDP has a positive and significant impact on its current value at 1% level.

Results of dynamic panel results show

	Dynamic panel					
	ANS		EPI		SHDI	
	GMM-DIFF	GMM-SYS	GMM-DIFF	GMM-SYS	GMM-DIFF	GMM-SYS
Y(t-1)		0.8904 (0.000)***	0.9880 (0.000)***	0.9880 (0.000)***	0.7741 (0.000)***	0.9515 (0.000)***
REN	0.2306 (0.059)**	0.2550 (0.037)**	0.0062 (0.337)**	0.0062 (0.360)**	0.0653 (0.009)	0.0053 (0.050)**
NRN	-0.0192 (0.963)	-0.1338 (0.00)***	-0.1338 (0.000)***	-0.2010 (0.391)***	-0.4158 (0.000)	0.0027 (0.606)
GDP	0.0206 (0.308)	0.0364 (0.639)	-0.0894 (0.000)***	-0.0900 (0.000)***	-1.4559 (0.014)	-0.0853 (0.000)***
MHDI	0.2565 (0.919)	0.1891 (0.527)	-0.1578 (0.000)	-0.1535 (0.000)***	-	-
$MHDI^2$	-	-	0.0385 (0.000)***	0.0228 (0.000)	-	-
BUREAU	-0.0126 (0.910)	-0.0806 (0.469)	0.0226 (0.130)	0.0191 (0.142)	0.0830 (0.005)	0.0022 (0.679)
RR	-0.0105 (0.062)	-0.0151 (0.069)*	-0.0051 (0.000)***	-0.0080 (0.000)***	-	-
POP	-0.2811 (0.003)**	-0.1515 (0.034)**	0.0880 (0.000)	0.0880 (0.000)	0.0040 (0.100)	0.0024 (0.362)
POLI	-0 .1505 (0.010)*	-0.1798 (0.024)**	-0.0293 (0.001)	-0.0306 (0.030)**	0 .0600 (0.200)	0 .0859 (0.172)
CORR	-0.7552 (0.017)*	0.3700 (0.014)**	0.0229 (0.000)***	0.0187 (0.000)***	0.0024 (0.000)***	-0.0889 (0.000)***
Quality	-0.4030 (0.002)***	-0.4324 (0.040)*	-0.0121 (0.000)***	-0.0715 (0.050)**	-0.0555 (0.000)***	-0.0889 (0.000)***
FREE	-0.25671 (0.180)	-0.1418 (0.910)	0.0372 (0.605)	-0.0124 (0.783)	-0.1664 (0.052)**	-1.2143 (0.010)**
Price	0.3794 (0.270)	0.4207 (0.854)	-0.0573 (0.303)	-0.0600 (0.379)	-0.1001 (0.005)	-0.1228 (0.002)***
C	-37.3081 (0.072)*	8.2737 (0.199)	-3.1639 (0.000)***	-3.1535 (0.000)***	-2.2887 (0.000)	-0.1074 (0.201)
AR (1)	-1.98 (0.048)	6.40 (0.009)	-1.65 (0.098)*	-2.27 (0.023)*	15.72 (0.000)***	-2.94 (0.000)***
AR (2)	-0.95 (0.341)	8.2737 (0.199)	1.27 (0.203)	-0.78 (0.386)	16.73 (1.000)	-3.95 (0.444)
Hansen test p value	131.19 (0.010)**	61.17 (0.264)	181.20 (0.002)***	2.40 (0.663)	6.76 (0.080)*	7.80 (0.554)
N.of obs						
N. of .cou						

government. The figure shows that government efficiency (which measures how governments spend their money

on public welfare) is positively correlated strongly with and control of corruption. In the least developed countries, the "South", poverty and environmental degradation frequently go hand in hand, fanning conflicts between population groups (social breakdown): conflicts over access to water, food, .. .bloquant the economic development prospects (insecurity ..). In addition, institutions that respect the rule of law, protection of property rights and contract enforcement, and put effective constraints on the leaders have shown to be associated with higher levels of economic, social and ecological. Also, institutions which respect the rule of law, protection of property rights and contract enforcement, and put constraints on effective leaders are shown to be associated with higher levels of economic, social and ecological This study contributes to the literature using the Arellano-Bond technique GMM. Unlike previous studies on the sustainability of natural resources, this study integrates renewable energies in the sustainability process. for these countries, it is required to develop new renewable energy technologies, reduce levels of corruption, and improve educational system for HDI. This will also have a key role in environmental conditions amelioration by substituting conventional fuels with renewable energies that produce no air pollution or greenhouse gases.

Table 6 Definition of Data and their sources

Variables	Definition	Sources
REN	Renewable energy consumption	International Energy Agency, BP Statistical Review of World Energy, 2015
NRN	Non renewable energy consumption	
EPI	Environment performance index	Yale University, 2016
GDP	Gross domestic product	World Bank, WDI 2014
IDH	Sustainable human development index	World Bank, WDI CD-ROM, 2014
BUREAU	Bureaucracy	World Bank, WGI 2014
RR	Resource richness	
POP	Population	
POLI	Political instability	
CORR	Corruption	
Quality	Quality of institutions	
FREE	Economic Freedom index	Heritage index, 2016
Price	Energy price	World Bank, WDI CD-ROM, 2014

REFERENCES

1. Atkinson, G., Hamilton K., 2003. Saving, growth and the resource curse hypothesis. World Development 31 (11), 1793-1807.
2. Atkinson, G., Hamilton, K., 2007. Progress along the path: evolving issues in the measurement of genuine saving. Environmental and Resource Economics 37 (1), 43-61.
3. Dietz, S., Neumayer, E., 2004. Weak and strong sustainability in the SEEA: concepts and measurement. Ecological Economics, 61 (4), 617-62
4. Ferreira, S., Hamilton , K., Vincent, J.R., 2008. Comprehensive Wealth and Future Consumption: Accounting for Population Growth. The World Bank Economic Review, 22, 233-248.
5. Lee, J.W., Brahmaserene, T., 2013. Investigating the influence of tourism on economic growth and carbon emissions: Evidence from panel analysis of the European Union. Tourism Management 38, 69–76.
6. Levin, A., Lin, C.F., Chu, C.S., 2002. Unit root tests in panel data: Asymptotic and finite sample properties. Journal of Econometrics 108, 1–24.
7. Omri, A., Kahouli, B., 2014a. The nexus between foreign investment, domestic capital and economic growth: empirical evidence from the MENA region. Research in Economics (in press), http://dx.doi.org/10.1016/j.rie.2013.11.001. UNDP (United Nations Development Programme), 2014. Human Development Report, pp. 153-156. New York, Oxford University Press.
8. Gorkemli Kazar Altug Kazar (2014),
9. The Renewable Energy Production-Economic Development Nexus, International Journal of Energy Economics and Policy,Vol. 4, No. 2, 2014, pp.312-319

10. The first part of the estimated function has a negative slope; it means that the global tendency of countries, when we gradually move on HDI, start with a medium environmental condition and gradually decrease, up to the minimum point (0,525; 0,459).
11. As pinpointed by UNDP the value of HDI 2012 under 0,466 indicate a low human development (HDR, 2013, p.146) and the EPI low performance benchmark is comprises in the interval from 0 to 0,507.
12. Therefore, countries, which are located in the area below the minima for both HDI and EPI, evidence a very low sustainability level.
13. On the contrary, after the minimum, the longest part of the function has an increasing tendency as to say that when human development gradually increase, from a medium level onwards, also the environmental quality follows the same trend.
14. This positive tendency is to attribute to the attainment of policy at various level, in line with the countries development.
15. It is interesting to note that the regression function seems to divide in two parts the plot according to the level of environmental performance and that some countries share a very close HDI value, in spite of a very different environmental condition. Some examples, labelled on the Fig.1, are Nepal-Yemen, Albania-Kazakhstan, Latvia-Qatar and Norway-United States.
16. Within this framework, we can infer that for all levels of HDI, the environmental quality of countries that lie below the regression line is poor, and then the objective of global policies should be in direction to enhance the level of environmental performance, at least up to the average value fixed from the estimated function.