National happiness and Environment quality in Africa.

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Abstract

Using Ordinary Least Squares, the Generalized Method of Moments and Estimate fixed-effect panel threshold model, this paper analyses the effect of environment on happiness in a panel of 30 African countries over the period 2006-2014. We find that environment quality affects happiness. The linear model shows that actually the degradation of environment increase happiness. However, the Estimate fixed-effect panel threshold model concludes that the relation between happiness and Greenhouse Gas are not a linear but quadratic. The estimation of quadratic equation revealed that this relationship takes the form of an inverted U. These results mean that in the long run environment negatively affects the happiness of people in Africa. Thus, the effect of environmental quality on happiness in Africa depends on the level of Greenhouse Gas emissions and the level of income per capita.

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Key words: National happiness, Environment quality, Africa

1. **Introduction**

Natural resources are assets taken from the wild to, in most cases, improve the living conditions of the population. In Africa, economies are dominated by the exploitation of these natural resources that contribute to the formation of national wealth and the happiness of individuals. This (natural resource) has a triple dimension, namely economic, social and ecological.

Any economic policy, beyond promoting economic activity, will have value only if it contributes to human well-being or happiness (Frey and Stutzer, 2002). Human well-being has multiple constituents, including basic material for a good life, environment, freedom and choice, health, good social relations, and security (OECD, 2011). Due to its strong socio-economic aspects, happiness requires a wider context to understand its determinants. This study is one of those which has been satisfactorily analysed in the field of environmental degradation.

The ecological upheavals affect us directly. Indeed, the fear of no longer flourishing on a planet battered by climate upheavals, economic instability and ideological wars is more and more felt. This is why the state of our environment is among our first fears (Chêne, 2009). Today, everyone understands that talking about saving of the environment is not just about whale conservation, but about our own survival and, most importantly, about our children's survival.

Africa is today at a crossroads of opportunities to re-evaluate its development model, integrating all socio-economic, political and environmental parameters. Indeed, societies that depend on marine and aquatic resources and the ecosystems that they shelter must stand ready to follow a development trajectory centered on human happiness and the sustainability of ecosystems. To chart its course, Africa must define its own vision of prosperity and progress, and encourage innovative approaches and ideas that will improve the well-being of people and their environment.

Therefore, we can ask ourselves whether the African people need nature to be happy? Or to defend the environment is not equally to defend our happiness? In other words, what is the impact of environmental change on human well-being in Africa?

This article combines advances on environment and knowledge about happiness, to provide a clear synthesis of the interaction between human happiness and the natural environment. It also aims at showing that the quest for happiness can be a source of sustaining the integrity of nature in Africa.

There is little empirical literature on the effect of environmental degradation on happiness.

Soper (2001) first examines the arguments that lead us to be wary of the concept of "nature" because of many ideological roles it has been led to play. Then, he shares the concern of ecologists about the destruction of nature by man and assert their assertions about the calamitous consequences on the well-being (happiness) among others the inability to respect the limits and the constraints that nature imposes. Indeed, as Harribey points out (2004a, 23), environmental degradation and depletion of natural resources are closely correlated with development. However, there is a decline in the quality of life due to the costs of environmental degradation and crime (Talberth, 2006).

Lambin (2009) examines whether strictly anthropocentric and even egocentric motivations ("I defend my happiness") can further facilitate the transition to a more sustainable mode of development, or whether it is necessary to call for altruistic feeling of responsibility towards future generations.

Beyond environmental issues, Nicholas Stern's report, released in 2006, launched a call to action on the basis of economic concerns. The conclusions of the study were that the costs of inaction in relation to climate change were greater than the costs of action, which had to be implemented now (Stern, 2006). A posteriori, the author even asserts to have underestimated the environmental impacts of human actions (Elliott et al., 2013).

2. Methodology, non-linear test and data

The empirical approach is designed to estimate the effect of environmental degradation on happiness in African countries. In this section the estimation strategy and Estimate fixed-effect panel are discussed (section 2.1) and the data are described (section 2.2).

2.1. Methodology

In this article, we opt for a triple specification namely the linear, threshold regression and quadratic model. This is justified by the fact that degradation as well as the improvement of the environment can contribute to happiness. Indeed, by using products from the environment (wood, agricultural work, etc.) the human being contributes to the emission of greenhouse gases while improving its happiness. Similarly, by improving the quality of his environment, he also finds his happiness (good health, better air quality, etc.). Thus, we define the basic linear model as follows:

$$Happiness_{it} = \alpha_0 + \alpha_1 Happiness_{it-1} + \alpha_2 GHG_{it} + \alpha_3 X_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (1)$$

Where $Happiness_{it}$ is the happiness for country i in period t measured by lifeladder. GHG_{it} (Greenhouse Gas) is environmental degradation indicators. X_{it} is a vector which includes control variables. μ_i is an unobserved country-specific effect, ν_t is time specific effect and ε_{it} is the error term.

To examine the nonlinear threshold effect between happiness and Greenhouse Gas, we adopt the threshold regression model developed by Hansen. This model can avoid the disadvantages inherent in the traditional threshold model and has the following advantage: first, it does not need to set the nonlinear equations; second, the number of the threshold is totally determined endogenously by the sample data; third, it will calculate the confidence interval of parameters according to the asymptotic distribution theorem; four, it will estimate the statistical significance using the bootstrap method.

There is little work on the consideration of non-linearity especially in developing countries. Non-linearity is however an important characteristic of the economic dynamics and its modelling requires a particular attention in the choice of the model to use. Previous studies have shown that the most appropriate pathway for modelling non-linearity is that of dietary change models. The reasons for this choice are simple: besides the fact that these models provide an economic explanation for this non-linearity, they also allow an economic series to have a different dynamic according to regimes.

In our work, we use the brutal transition mechanism of Bai and Perron (2003) originally proposed by Hansen (1999). This transition is indeed used when one has an indicator function, the transition from one regime to another can be carried out in one period by comparing the transition to a threshold. If this variable is lower or higher than the selected threshold, the transition is instantaneous. In this modelling, the dependent variable is generated by two separate processes. We are in the dynamics of a process or another depending on the value taken by a variable called transition variable. With the transition operating through a variable and an observable threshold, we take the wealth indicator (lnGDP) as the transition variable in our specification. Indeed, we assume that the relationship between happiness and environmental degradation strongly depends on the level of wealth.

We adopt the panel fixed effects threshold estimation model to test the existence of threshold effects in our specification. The test statistic is actually a Fisher parameter given by:

$$F = \frac{S_0 - S_1(\hat{\gamma})}{\hat{\sigma}^2} \qquad (2)$$

S_0 is the sum of the squares of the residuals of the linear model (H_0) and $S_1(\hat{\gamma})$ the sum of the squares of the residuals of the nonlinear model.

However, a major problem arises. The distribution of the statistics of the test is not defined because the estimator $\hat{\gamma}$ is not independent of the observations of the model. To overcome this difficulty, Hansen (1996) proposes to simulate the distribution of F by bootstrap.

If the non-linearity hypothesis is validated after the estimation of fixed-effect panel threshold model, we will estimate Equation 3 below. The estimation of this equation will allow us to determine the form of the relationship between the degradation of the environment and happiness.

$$Happiness_{it} = \alpha_0 + \alpha_1 Happiness_{it-1} + \alpha_2 GHG_{it} + \alpha_3 GHG_{it}^2 + \alpha_4 X_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (3)$$

The presence of the lagged value of happiness places our model inside the context of dynamic panel model. We then estimate Equation (1 and 2) by using the Generalized Method of Moments (GMM) proposed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). This method enables us to control for unobserved country-specific factor. Moreover, the presence of a lag-dependent variable on the right hand of the equation and there verse causality between environmental degradation and happiness will lead to simultaneity bias of the regression's coefficients. GMM estimation technique is developed to address such endogeneity problem, omission of relevant variables, measurement error and sample selectivity. The GMM technique is declined in two versions: the difference GMM where the lagged levels of the explanatory are used as instruments and system GMM where the combination of the regression in differences and the regression in levels are used. However, Bond et al. (2001) have recommended that the system GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998) can dramatically improve efficiency and avoid the weak instruments problem in the first -difference GMM estimator developed by Arellano and Bond (1991). The consistency of the System GMM estimator is verified by using two specification tests: the validity of the assumption that the error term does not exhibit serial correlation (AR (2)) and the validity of the instruments (Hansen test).

2.2. Data

We investigate a panel of 30 African[1] countries over the period 2006-2014 with data from: World Development Indicators (WDI), World Resource Institute (WRI), and World Happiness Report (WHR). The periodicity under investigation starts from 2006 due to the fact that happiness variable from World Happiness Report are only available from the year 2005 and at that date, several African countries have no data available. The dependent variable is happiness or subjective well-being measured by life ladder from the World Happiness Report. This variable is obtained by inviting respondents to think of their lives as a ladder, with the worst possible life for them as 0, and the best possible life as 10. Our main independent variable is environmental degradation. This variable measured by GHG (Total GHG Emissions in MtCO2e) provide from WRI. Next to the environmental variables, we include two control variables, namely: (i) GDP growth (WDI) and (ii) Healthy life expectancy at birth (Healthy) provide from WHR.

Income per capita has been documented to increase well-being because it raises consumption, health, educational level, and employment (Dolan et al., 2008). Countries with higher healthy life expectancy at birth have also been documented to be associated with higher level of happiness (Helliwell et al., 2018). The summary statistics are provided in Table 1 while Table 2 displays the correlation matrix.

Table 1 : Descriptive stastitics

	Variables	Obs	Mean	Std. Dev.	Min	Max	Source
interest variable	lnGHG	257	3.240201	1.223119	.4431388	6.263198	WRI
	lnGHG2	257	6.476612	2.446471	.8862776	12.5264	WRI
Happiness	LifeLadder	257	4.265788	.5884246	2.701591	5.6082	WHR
Control variable	Healthylife	257	51.10554	5.781514	37.76648	65.88056	WHR
	lnGDP	257	7.882669	.858193	6.377396	9.731311	WDI

[1] Benin, Botswana, Burkina Faso, Cameroon, Chad, Congo (Brazzaville), Egypt, Gabon, Ghana, Guinea, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe.

Table 2: Correlation matrix

	lnGHG	lnGHG2	LifeLadder	Healthylife	lnGDP
lnGHG	1.0000	0.9999	0.4215	0.0816	0.4506
lnGHG2		1.0000	0.4218	0.0826	0.4527
LifeLadder			1.0000	0.1578	0.4005
Healthylife				1.0000	0.4831
lnGDP					1.0000

3. Empirical results

Table 3, 4 to 5 and 6 present results corresponding to the effect of environmental degradation using the linear, threshold regression and quadratic model respectively.

3.1. Main linear equation results

As a starting exercise, we estimate the impact of environment on happiness by ordinary least squares (OLS) and system GMM. To provide the most data on our dependent variable (life ladder), we utilize the largest possible sample of African countries by taking a panel of 30 countries. Table 3 presents the results of the model estimations, which allows for an effect of environmental degradation on happiness. The results in Table 3 show that all methods used to estimate the impact of measure environment have a positive and statistically significant coefficient. For example the column 2 and 4 suggests that a 1-unit increase Greenhouse Gas increases the happiness by 0.122 and 0.345 unit respectively. Therefore, better life quality in Africa can be achieved by allowing mineral raw material (freshwater, aggregates, etc.); wild product (wood, fish, prey, etc.); fossil organic matter (petroleum, coal, natural gas, etc.). These activities certainly contribute to the improvement of the happiness of the people but also to the increase of GHG emissions. Overall, the results displayed in Table 3 suggest that emission of GHG increases the happiness of people.

These results are in agreement with a number of empirical and theoretical studies which show that they are conditioned by the exploitation of natural resources. Tomo (2012) shows that exploitation of natural resource or human activities that contribute to degradation of environment, ameliorate well-being of present generation. Miossec (2001) concludes that the culmination of the exploitation of natural resources is the improvement of well-being. For Arrow (1995), a moderate increase in temperature can have little effect on the well-being of

humanity. Clark (1989) states that humans consume the primary production of all terrestrial ecosystems for their survival and well-being. They derive their food, their clothes, their houses, their modes of transport, and their luxuries like those of first necessity. Thus, consumption, which can be defined as the acquisition of a product to meet a need, is transformed into what some people call consumerism whose object is to acquire goods for the satisfaction of emotional, social needs and emotional (Leonard, 2010).

Remaining independent variables also have the expected signs as found in other studies. The coefficients associated with GDP growth and healthy life expectancy at birth are positive and significant, suggesting an improvement in happiness with the increase in GDP growth (Wu and Li, 2017) and a better life expectancy at birth (Helliwell et al., 2018).

Table 3: results of the linear equation (equation1)

VARIABLES	LifeLadder			
	OLS		System GMM	
lnGDP		0.152***		0.553*
		(0.0506)		(0.323)
Healthylife		0.811**		0.781*
		(0.317)		(0.414)
lnGHG	0.203***	0.122***	0.194**	0.345**
	(0.0274)	(0.0328)	(0.0831)	(0.138)
L.LifeLadder			0.359***	0.455***
			(0.0599)	(0.0342)
Constant	3.609***	1.907***	3.346***	4.045*
	(0.0982)	(0.406)	(0.442)	(2.056)
Observations	257	255	227	227
Number of countries	30	30	30	30
R-squared	0.178	0.251		
AR(1)			4.11e-05	0.000147
AR(2)			0.425	0.730
Instruments				
Hansen OIR			0.325	0.443
F	54.63	18.92	27.49	48.54

*Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*

3.2. Results of a fixed-effect threshold panel model

The following table gives the results of the linearity test performed on our linear model (equation 1).

Tableau 4: results of threshold effect test

Hypothèses testées	10% ; 5% ; 1% critical points	F stat	Prob	Seuil	IC à 95%
H_0 : No Threshold H_1 : Single Threshold	(12.9534 14.9989 22.1906)	15.23	0.05	7.1025	(7.0619, 7.1043)
H_0 : Single Threshold H_1 : Double Threshold	(19.3560 22.6318 26.3129)	7.89	0.48		
H_0 : Double Threshold H_1 : Triple Threshold	(16.5025 18.3019 27.9180)	6.60	0.67		

It appears from the table that the single threshold effect model is significant at 5%. Conversely, the double and triple threshold models were not significant. Thus for our model, we retain the single threshold effect with the value of lnGDP of 7.1025 as the threshold value. With these results, it is important to analyse the relationship between happiness and the quality of the environment through a non-linear relationship. The relationship between happiness and environmental degradation therefore changes when the level of wealth reaches a certain level (7, 1025). Thus, the sign of the effect of the quality of the environment on happiness does not change with wealth. However, its magnitude becomes less important with the level of wealth.

The result of the threshold effect recorded in the table below thus indicates a negative coefficient of -1.273 when the lnGDP variable is less than 7.1025. However, beyond this threshold, the effect of the environmental quality decreases slightly to -1.2424. Both coefficients are significant at 5%. Thus, the effect of the quality of the environment on happiness is weakly influenced by the level of average standard of living measured here by the level of income per capita.

Table 5: Result of the estimation of the threshold effect

Variables	Variables	Single-Threshold Effect
LifeLadder(-1)	LifeLadder(-1)	0.1240
		(1.45)
Healthylife	Healthylife	0.6117
		(1.00)
	lnGHG (lnGDP <7,1025)	-1.273**
lnGHG		(-2.18)
	lnGHG (lnGDP ≥7,1025)	-1.2424**
		(-2.18)

*Student statistic in parentheses *** p<0.01, ** p<0.05, * p<0.1*

This result confirms that the relationship between happiness and the quality of the environment is quadratic.

3.3. Quadratic equation result

The results reported in Table 3 potentially suffer to the fact that they don't consider the environment degradation can ameliorate or degrade the happiness. We thus estimate the

quadratic form relationship (equation 2) by using system GMM. The results are presented in Table 4. The different diagnostic tests are respected. All the models passed the AR (2) tests for second order serial correlation as indicated by p-value. Too many instruments can severely weaken and bias the Hansen over identifying restriction test and therefore, the rule of thumb is that the number of instruments should be less than the number of countries (Roodman, 2009). The system GMM estimates generate 16 instruments which are lower than the number of countries (30 sample countries), hence regression results are free from instruments proliferation.

Table 6: Quadratic model results

VARIABLES	LifeLadder	
	System GMM	
L.LifeLadder	0.0610	0.212*
	(0.141)	(0.110)
lnGHG	8.731*	18.50*
	(4.823)	(10.44)
lnGHG2	-4.189*	-9.212*
	(2.384)	(5.234)
Healthylife		-0.0186
		(0.0112)
lnGDP		0.272
		(0.197)
Constant	2.847**	1.939
	(1.280)	(1.343)
Observations	227	227
Number of countries	30	30
GHG at return point	2,84	2,73
AR (1)	0.0466	9.95e-05
AR(2)	0.278	0.609
Instruments		
Hansen OIR	0.937	0.829
F	1.429	6.329

*Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*

Estimated quadratic form confirms that the relationship between environmental degradation and happiness are not linear. It takes a form of inverted U for African countries. The GHG for return point (column 1) is situated at 2, 84 MtCO2eq. At that point the GHG affects negatively the happiness of people.

This result confirms the idea that environmental degradation occasioned by overexploitation of natural resources actually contributes to the improvement of happiness in Africa and this up to

a certain point where it begins to be harmful. This result suggests that the happiness of people in Africa depends on the quality of the environment in the long run.

This result is confirmed by a set of empirical works. For Soper (2001) the nature that ecologists want to preserve is also the one that has been dominated and destroyed in the name of the "naturalness" of a certain order of human relations, needs, property rights and different forms of exploitation. Lambin (2009) demonstrates that there is an interaction between human happiness and the environment. For him, it is possible to reconcile the quest of happiness and the maintenance of the integrity of nature. For Chêne (2009) the environment affects the health and future of men. Overconsumption of environmental goods, that is, consumption that goes beyond real needs and is associated with a waste of resources, is at the root of the divorce between the environment and happiness (Leonard, 2010) . This call to change of the mode of consumption, contrary to what many claim, would not be an obligation generating many deprivations, but rather the conscious and thoughtful choice to move towards a better, happier society (Ariès, 2007; 2010). Thus, natural resources should be exploited in such a way that the heritage represented by the environment is not altered and that people living through natural resources see their living conditions improve today and in the future.

4. Conclusion

Due to the lack of happiness data for many African countries, there is almost no analysis at the level of the relationship between environmental degradation and happiness. The few existing studies focus on developing countries or developing countries. To fill this gap, this study has investigated how environment quality affects happiness in 30 African countries for the period 2006-2014. We use total Greenhouse Gas emissions in MtCO2e to measure environment quality. Life ladder is used to measure happiness. The empirical evidence is based on Ordinary Least Squares, System Generalized Method of Moments and Estimate fixed-effect panel threshold model. This paper finds that environment quality is positively and significantly correlated to the happiness of the population in Africa with linear model (Equation 1). Estimate fixed-effect panel threshold model shows that the relationship between happiness and GHG are not linear but quadratic. Thus, equation 2 shows that the relationship between environment quality and happiness are quadratic. This relationship takes the form of inverted ‘‘U’’. This results mean that in the long run environment negatively affects the happiness of people in Africa. Thus, the effect of environmental quality on happiness in Africa depends on the level of Greenhouse Gas emissions and the level of income per capital.

References

Arellano, M. and Bond, S. (1991): ‘‘Some tests of specification for panel data: Monte carlo evidence and an application to employment equations’’. The review of economic studies, 58(2):277–297.

Arellano, M. and Bover, O. (1995): ‘‘Another look at the instrumental variable estimation of error-components models’’. Journal of econometrics, 68(1):29–51.

Ariès, P. (2007) : ‘‘La décroissance. Un nouveau projet politique’’, Clamecy, Éditions Golias, 362 p.

Ariès, P. (2010) : ‘‘Décroissance et gratuité. Moins de biens, plus de liens’’, Villeurbanne, Éditions Golias, 155 p.

Arrow, J. K. (1995) : ‘‘Effet de serre et actualisation’’, Revue de l’énergie octobre 1995, page 25.

Bai, J. and Perron, P. (2003): ‘‘Computation and analysis of multiple structural change models’’. Journal of Applied Econometrics, 18(1), 1-22

Blundell, R. and Bond, S. (1998): ‘‘Initial conditions and moment restrictions in dynamic panel data models’’. Journal of econometrics, 87(1):115–143. 2.1

Bond, S. R., Hoeffler, A., and Temple, J. R. (2001): ‘‘GMM estimation of empirical growth models’’.

Chêne, M. (2009) : ‘‘L’économie politique de la réforme des marchés publics’’, Bergen, Norvège : Centre de ressources anti-corruption, transparency International.

Clark, W. (1989) : ‘‘La gestion de la planète’’, pour la Science, numéro spécial Gérer la planète, no 145, novembre 1989, p. 26.

Dolan, P., Peasgood, T., and White, M. (2008): ‘‘Do we really know what makes us happy?’’, a review of the economic literature on the factors associated with subjective well-being. Journal of economic psychology, 29(1):94–122.

Eliott, L. and Stuart, H. (2013): Nicholas Stern: “I got it wrong on climate change it's far, far worse”. In Business Green. Climate change. http://www.Businessgreen.com/bg/news/ 2239263 /nicholas-stern-i-got-it-wrong-on-climate-changeits-far-far-worse.

Frey, B. S. and Stutzer, A. (2002): ‘‘The economics of happiness’’. World Economics, 3:25–41.

Hansen, B.E. (1996) : ‘‘Inference when a nuisance parameter is not identified under the null hypothesis’’. Econometrica 64, 413-430.

Hansen, B.E. (1999): ‘‘Threshold effects in non-dynamic panels : Estimation, testing and inference’’. Journal of Econometrics, vol 93, pp 345-368.

Harribey, J.-M. (2004) : ‘‘Le développement a-t-il un avenir?’’ Pour une société économie et solidaire. Barcelone, Mille et une nuits, 242 p.

Helliwell, J. F., Huang, H., Grover, S., and Wang, S. (2018): ‘‘Empirical linkages between good governance and national well-being’’. Journal of Comparative Economics, 46(4):1332–1346.

Lambin, E. (2009) : ‘‘Une écologie du bonheur’’, Editions Le Pommier, Parution : 08 septembre 2009.

Leonard, A. (2010) : ‘‘Planète jetable: produire, consommer, jeter, détruire’’, Montréal, Éditions Éco société, 393 p.

Miossec, A. (2001) : ‘‘Le concept de développement durable et l’interrogation de la nature’’, Paris : la géographie n°1502 bis 2001.

OECD (2011): How’s life? Measuring well-being.

Roodman, D. (2009): ‘‘How to do xtabond2: An introduction to difference and system gmm in stata’’. The Stata Journal, 9(1):86–136.

Stern, N. (2006): ‘‘Stern Review: The Economics of Climate Change’’, In HM Treasury. Independant reviews. http://www.hm-treasury.gov.uk (Page consultée le 27 décembre 2012).

Soper, K. (2001) : ‘‘Écologie, nature et responsabilité’’, Dans Revue du MAUSS 2001/1 (n 17), pages 71 à 93.

Talberth, J., Cobb, C. and Slattery, N. (2006): ‘‘The Genuine Progress Indicator 2006. A Tool for Sustainable Development’’. In Redefining progress. The Nature of Economics. Genuine Progress Indicator. http://rprogress.org/publications/2007/GPI%202006.pdf (Page consultée le 25 janvier 2013).

Tomo (2012): ‘‘Ressources naturelles et développement durable dans les économies subsariennes le rôle de l’union européenne’’, Doctorat Nouveau Régime, Université de Lorraine.

Wu, X. and Li, J. (2017): ‘‘Income inequality, economic growth, and subjective well-being: Evidence from china’’. Research in Social Stratification and Mobility, 52:49–58.