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Energy consumption and economic growth in sub-Saharan Africa: An asymmetric cointegration analysis

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Abstract. This paper investigates the asymmetric effect in the energy-growth nexus. Using the data for real GDP per capita and energy consumption per capita over the period 1971-2008, we examine the relationship for 12 sub-Saharan African countries employing hidden cointegration approach. For Gabon, Nigeria and Côte d'Ivoire, the results show that their growth rates could be adversely affected by conservation policies. However, for Benin, Kenya and Sudan the results show that conservation policies could enhance the growth process in these countries. We also find instances of policy dilemma for Nigeria and Benin that conform to both the growth and the conservation hypotheses.

JEL Classification: Q43; C54; C22.
Keywords: Energy; Growth; Asymmetric Cointegration; sub-Saharan Africa.

Résumé. Cet article étudie l'existence d'effets asymétriques dans la relation énergie-croissance. En utilisant des données de PIB réel par habitant et de consommation d'énergie par habitant au cours de la période 1971-2008, nous examinons cette relation pour 12 pays africains. Pour le Gabon, le Nigeria et la Côte d'Ivoire, les résultats montrent que leur taux de croissance pourrait être affecté négativement par les politiques de conservation. Toutefois, pour le Bénin, le Kenya et le Soudan les politiques de conservation pourraient améliorer le processus de croissance dans ces pays.

Classification *JEL* : Q43 ; C54 ; C22.
Mots-Clefs : Energie ; croissance ; cointégration asymétrique ; Afrique sub-saharienne.

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1. Introduction

The core of research on energy consumption and economic growth in the last two decades has focused on the existence and the direction of causality between the two series. Not surprisingly, this research reflects the issues in an ongoing debate on whether energy consumption can be reduced without adversely affecting the growth process. Hence, investigating the causality and cointegration properties is a legitimate research issue. The call for reduction in energy consumption in the first instance is a consequence of the need to mitigate the amount of pollution and global warming as well as enhancing energy efficiency. Consequently, a number of authors have studied this relationship. Starting with the pioneering work of Kraft and Kraft (1978), the list of authors includes Yang (2000), Stern (2000), Asafu-Adjaye (2000), Soytas and Sari (2003), Jumbe (2004), Shiu and Lam (2004), Yoo (2006), Mozumbder and Marathe (2007), Chontanawat *et al.*, (2008), Akinlo (2008), Wolde-Rufael (2005, 2009, 2010) and Tsani (2010).

This paper contributes to the literature by examining cointegration between energy consumption and economic growth for some sub-Saharan African countries bearing in mind that this relationship may be subject to nonlinearity. Previous studies examined this relationship either for some selected sub-Saharan African countries (see, for example, Wolde-Rufael, 2005, 2009; Akinlo, 2008) or for some individual countries (see, for example, Jumbe, 2004) assuming a linear cointegration between the variables. If it is true that the data-generating process underlying this relationship is nonlinear, the models that these authors used are clearly misspecified and the conclusions that they inferred may not be correct. The present study emphasizes the exigency of looking more closely at the question of cointegration between economic growth and energy consumption in the context of asymmetrically cointegrating relationship. The vehicular method to studying this phenomenon is the hidden cointegration approach developed in Granger and Yoon (2002) and in Schorderet (2004). The position of these papers is that although any two series may not be *linearly* cointegrated, there is still the possibility of asymmetric cointegration between them. The upshot is that there may be hidden dynamics in an otherwise non-cointegrating relationship that drives the components – positive or negative – of the series rather than the series themselves.

For sub-Saharan African countries, the issue of energy consumption or conservation is an interesting one since promoting growth necessarily requires intensifying energy use. Yet, only a very tiny body of literature exists on the nexus between energy use and economic growth in Africa. It is submitted however that this body of literature is growing. Existing literature characterizes the relationship for (sub-Saharan) African countries by testing for the Granger non-causality and estimating the cointegrating vectors between energy consumption and economic growth (Wolde-Rufael, 2005, 2009; Akinlo, 2008). A noticeable finding in these studies as in the studies for other economies is conflicting evidence on the causal relation, where causality may run from economic growth to energy consumption for a particular country but run from energy consumption to economic growth for another. Also with respect to cointegration issue, conflicting evidence is extant. For some economies, evidence shows no cointegration between these variables whereas for others cointegration is confirmed. Wolde-Rufael (2009) attempts to fill this gap by expanding the bivariate VAR model to a four-variable VAR model augmented with labour force and capital as control variables omitted