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Woody Biomass Energy Consumption and Economic Growth in Sub-Saharan Africa

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Abstract

In this study, determinants of the relation between woody biomass energy consumption and economic growth were discussed. The relationship was examined by Autoregressive-Distributed Lag (ARDL) model for selected Sub-Saharan African countries such as Angola, Benin, Guinea-Bissau, Mauritania, Niger, Nigeria, Seychelles and South Africa for the period of 1980-2013. According to empirical results, there is unidirectional causality from woody biomass energy consumption to economic growth for Angola, Guinea-Bissau and Niger; from economic growth to woody biomass energy consumption for Seychelles. The bidirectional relationship is supported for Benin, Mauritania, Nigeria and South Africa. The results of this paper demonstrate that structural changes should be implemented in renewable energy policies of the selected countries.

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1. Introduction

Energy dependence of the world mainly rests on fossil fuels, coal, petroleum, crude oil and natural gas as sources of thermal energy; gaseous, liquid and solid fuels and chemicals whose reserves are finite so in the danger of depletion. While fossil fuels as non-renewable energy sources, generated from died organisms, biomass energy is made of living organism so it can be recycled. The only nature-friendly and renewable energy resource known that can be originated from various sources and used as a substitute for fossil fuel is biomass which can be made of all water- and land-based organisms, vegetation and trees, virgin biomass and all dead and waste biomass such as municipal solid waste, bio solids (sewage), animal wastes (manures) and residues, forestry and agricultural residues and other types of industrial wastes (Klass, 2004).

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Biomass is briefly described as organic matter renewable over time, which can be used as a renewable energy resource, either directly by combustion to produce heat or indirectly, after conversion into various forms of semi-processed bio-fuels (such as wood pellets or ethanol). Wood is still one of the most important types of the biomass which defines 87% of the total biomass energy, either harvested used as fuel or derived from wood products. It is primarily consisted of carbohydrates and lignin produced by photosynthetic process and it can be directly used in modern energy applications such as producing electricity, liquid fuels and making bio-chemicals (Foster et.al. 2007; Wicke, et.al. 2011; Petrie, 2014). Woody biomass potential is generally abundant in stumps, tree branches, residuals of sawmills and sawdust, lops.

Benefiting from forests for bio-energy has gained popularity in the second half of the twentieth century because of the major issues such as high incidence of deforestation, high costs of fuel, scarcity in energy supply, dependence on foreign energy sources, global climate change and air pollution. Biomass is a most popular form of bio-energy, contributes to poverty reduction in developing countries, a notable tool in decreasing environmental degradation, meets the energy demand in all forms that people need, leads to developing agricultural productivity especially in rural lands and increased energy security and independence from imports. The better using of forest energy sources such as residues, wastes, balancing supply and demand across the various types of the forest and other wood-based biomass resources is necessary to meet energy demand of future. That deforestation highly relies on agro-industrial production. The primary wood-based uses of forest resources are used in household, businesses and industrial processing by utilizing wood and wood-based products (FAO, 2010; Eleri and Eleri, 2009).

Woody biomass is expected as the one of the main domestic energy sources by satisfying Africa's growing energy demand. Almost half of the world's population and nearly 81% of Sub-Saharan Africa (SSA) depend on woody biomass energy especially for cooking, household and economic activities. This rate is far beyond than other regions. For instance, even if usage of woody biomass rises in China, India and much of the developing countries, they cannot reach Sub-Saharan African's consumption because it is anticipated to grow over the next few decades. On the other side, woody biomass energy sector employs a remarkable workforce fetching for thousands of people (AFREA, 2011).

Accessing to energy, especially for renewable energy is so crucial for Africa which is in the tendency to sustained economic growth and has positive trends in human development indicators. Thus, bio-energy has a strategic role in the country's development. Bio-energy is currently the primary energy source for almost 2.7 billion people worldwide (Wicke, et.al. 2011; Stecker et.al. 2013), playing a traditional role in Africa by composing nearly 90% of total energy supply especially in Sub-Saharan Africa. Although the International Energy Agency (IEA) expects to decrease in total energy rate of biomass and wastes by 2035, it is predicted that biomass energy will still have substantial effect on the country's energy consumption (IEA, 2010; Stecker et.al. 2013). As well as the total primary energy demand, biomass and wastes have major share of total energy consumption of Africa. According to IEA's estimations, biomass and wastes will have share between 51% and 57% in Africa's total energy consumption by 2035. However, dependence on biomass energy varies across regions of Africa. For instance, African countries suffered from poverty have high biomass ratios in total energy, especially for woody biomass. In some countries such as Burundi, Rwanda and the Central African Republic, biomass energy utilization is 90% or greater (Dasappa, 2011; Stecker et.al. 2013). In Sub-Saharan Africa (SSA), people heavily rely on "traditional biomass energy" especially for cooking, lighting and heating considered other regions (Eleri and Eleri, 2009; Stecker et.al. 2013). In Africa, almost 80% of the population utilized from traditional biomass energy particularly for cooking. Therefore, renewable energy sources, especially woody biomass resources, have vital role in Africa so they should be used effectively (Stecker et.al. 2013).

South Africa has the highest woody biomass energy consumption in Africa. The producing of woody biomass energy provides wide opportunities for South Africa such as reducing in the amount of solid wastes, achieving climate conditions, creating employment occasions, improving life opportunities, chance for development. Historically, South Africa post-apartheid economy mainly hinge on mining operations which necessitates energy-intensive activity (Haw and Hagues, 2007; Etambakonga, 2013). Thus, the country's economy heavily bases on

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