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An Investigation of the Relationship between the Biomass Energy Consumption, Economic Growth and Oil Prices

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Abstract

This paper investigates the causality analysis among biomass energy consumption, oil prices and economic growth in Austria, Canada, Germany, Great Britain, Finland, France, Italy, Mexico, Portugal and the U.S. by using the autoregressive distributed lag bounds testing (ARDL) method, Granger causality and Toda and Yamamato non-causality test. The dataset covers the 1970-2013 period. Although many papers have explained the relationship between oil prices and economic growth since 1970, papers have not focused the relationship among biomass energy consumption, oil prices and economic growth. This paper focused the relationship because it was accepted the biomass energy is affected by economic growth and the oil price. For Austria, Germany, Finland and Portugal, the Granger causality test determined the evidence that the conservation hypothesis is supported. In state of U.S., the feedback hypothesis highlights the interdependent relationship between biomass energy consumption and economic growth. Tado Yamamoto test determined, for Austria, Germany, Finland and Portugal, the conservation hypothesis is supported. In state of U.S., the feedback hypothesis highlights the interdependent relationship between biomass energy consumption and economic growth.

Keywords: Economic Growth, Bıomass energy, ARDL, VEC, Granger Causality, Toda and Yamamato non-causality test

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1. Introduction

The economic system depends on traditional and modern energy. Energy consumption—especially biomass energy consumption—is old as humanity. Biomass is the only organic petroleum substitute that is renewable and is used to meet a variety of energy needs, including generating electricity, heating homes, fueling vehicles, and providing processed heat for industrial facilities (Ayres et.al 2007; Surmen, 2002). The term “biomass” is used for any plant material available for harvesting for a wide variety of possible uses such as food, building materials and fuel. Biomass can be used as direct substitutes for fuels or they can be processed into liquid fuels as oils and alcohol (Slupek et.al, 2000; Topcu and Ulengin, 2004; Balat et.al 2006; Balat, 2007). Biomass energy is most popular renewable energy in World in recent years.

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Fossil energy resources such as coal, oil, and natural gas have limited reserves, they are non-renewable, and can cause environmental pollution. These days, human beings are facing the dual pressure of economic growth and environmental protection, while energy problems are the basic problem related to national security and sustainable economic and social development (Chheda and Dumesic, 2007; Demirbas and Balat 2006; Jun et.al, 2011).

Biomass is a carbon-neutral form of energy that offers a potential alternative source of energy as a substitute for fossil fuel to will help mitigate climate change (Gumartini,2009). Biomass energy is the only renewable carbon energy, and with its virtues of low sulphur, low nitrogen, low ash, nearly zero-net CO_2 emission, and adequate sources, people are increasingly regarding and supporting its development and consumption (Chheda and Dumesic, 2007; Demirbas and Balat 2006; Jun et.al, 2011; Zhang et.al, 2011).

This paper will discuss the relationship among biomass energy consumption, oil prices, and economic growth. Many papers have explained the relationship between oil prices and economic growth since 1970. The existence of a negative relationship between oil prices and macroeconomic activity, or the asymmetric effects of oil prices were developed by Hamilton (1983) and Hooker (1996), who supported Hamilton's results. Other papers from this perspective were developed by Mork (1989), Hoover and Perez (1994), Lee et al., (1995), Hamilton (1997a, 1997b, 2003), Federer (1996), Balke et.al. (2002) and Bildirici, Alp and Bakırtaş (2011a, 2001b). The oil price affects both the economic growth and the rate of biomass energy consumption. The contribution of this paper is to analyse the relationship among biomass energy, oil price and GDP.

Economic background is located in the second section. Econometric theory and methodology are identified in the third section. The fourth section consists of the empirical results while the last section includes conclusions and policy implications.

2. Economic Background

Rural and poor urban households are the main consumers of traditional biomass energy because the alternative energy sources are very expensive. Commercial energy requires a well-developed infrastructure that is absent in many rural households. Therefore, traditional biomass energy is accessible for rural and urban poor households. Access to clean and affordable energy is essential to supply of heat, light and power to rural and urban poor areas as well as for other benefits such as the generation of income and health improvement (Gumartini 2009). Since the governments of many developed countries encourage the consumption of biomass energy as an alternative energy source, the share of modern biomass energy consumption in total energy consumption is continously increasing (Best and Christensen, 2003). Policy makers and theorists accept that there is value added in terms of the potential for increasing employment opportunities, enhancing energy security, generating income through job creation, and the development of a strong export industry, as well as the environmental benefits (Domac 2005).

The share of biomass energy in the total energy consumption varies among countries, but in general, the dependency on biomass energy is higher in poorer countries than in others. At present, Finland derives more than 20 percent of its total primary energy supply from biomass, while Sweden, Austria, and Australia have lower shares, about 17, 11 and 3.3 percent respectively (Gumartini 2009; Sadler, et.al. 2004). The main factors contributing to the difference in biomass energy consumption are urbanization, economic development and growth, standard of living (Dzioubinski, Chipman 1999), oil prices, and the number of people living in rural areas.

Biomass energy (traditional or modern) and/or fossil energy are essential for production, but standard macro-economic books employ capital and labor without energy in production functions while assuming energy as an intermediate product of the economy[1]. Many of today's models of long-term economic activity assume that changes in the energy supply or demand have no significant impact on economic growth (Ayres, Turton and Castenc 2007).

The literature on the causal relationship between biomass energy and economic growth is very sparse. Recently, Payne (2011), Bildirici (2012a,b;2013:2014) investigated the causal relationship between biomass energy consumption and economic growth by the ARDL method[2].

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[1] Many papers challenged the assumptions about energy made by macro-economics textbooks and discussed the importance of energy in economic growth. Kraft and Kraft (1978), Berndt (1978), Akarca and Long (1980), Proops (1984), Yu and Hwang (1984), and Erol and Yu (1987) investigated the relationship between energy consumption and economic growth in context of Granger Causality. The experiences of countries showed that energy plays a important role in their economic and industrial development, not only as a key input such as labor or capital, but also as a key factor in improving the quality of life (see Rosenberg (1998); Bildirici and Kayıkçı (2012) Bildirici, Bakırtaş and Kayıkçı (2012).

[2] According to Bildirici(2012), there is unidirectional causality from GDP to biomass energy consumption for Colombia and there is unidirectional causality from biomass energy consumption to GDP for Bolivia, Brazil and Chile. There is bi-directional causality for Guatemala. According to the

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