Energy Policy 100 (2017) 51–57

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

The renewable energy and economic growth nexus in black sea and Balkan Countries

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ARTICLE INFO

Keywords:
Renewable energy
Economic growth
Heterogeneous panel causality
Black Sea and Balkan Countries

ABSTRACT

The aim of this study is to explore the relationship between renewable energy consumption and economic growth within the framework of traditional production function for the period of 1990–2012 in 9 Black Sea and Balkan countries. For this purpose, we use Pedroni (1999, 2004) panel cointegration, Pedroni (2000, 2001) co-integration estimate methods and Dumitrescu and Hurlin (2012) heterogeneous panel causality estimation techniques. The study has concluded that there is a long term balance relationship between renewable energy consumption and economic growth and renewable energy consumption has a positive impact on economic growth. Heterogeneous panel causality analysis results support growth hypothesis in Bulgaria, Greece, Macedonia, Russia and Ukraine; feedback hypothesis in Albania, Georgia and Romania; neutrality hypothesis in Turkey and according to the panel data set including all nine countries the results support feedback hypothesis. With the findings, it was concluded that there is a significant impact of renewable energy consumption on economic growth in Balkan and Black Sea Countries.

1. Introduction

Energy is a vital production factor for all countries. Traditional energy sources like oil, natural gas and coal are considered to be the most effective drivers of economic growth (Ellabban et al., 2014). Social and economic developments in the last fifty years have rapidly increased the demand for traditional energy sources (Aslan et al., 2014). For example, while world energy demand is 4667 MTOE in 1973, this demand has risen to 9301 MTOE in 2013 by increasing two-fold. The share of oil, natural gas and coal are respectively 39.9%, 15.1% and 11.5% in meeting this demand in 2013. In other words, 65.5% of world energy need in 2013 was met with traditional energy sources (IEA, 2015). However, the world's dependence on traditional energy sources have brought many global problems. Today, energy independence and security of supply, energy price shocks, non-renewable features of oil, natural gas and coal as energy sources and global warming are considered the most fundamental global issues (Sadorsky, 2009).

On the other hand, these issues forced societies to find alternative energy sources to conventional energy sources (Bilgili and Ozturk, 2015; Ozturk and Bilgili, 2015). At this point attention to renewable energy as a significant alternative source has increased (Apergis and Payne, 2010). The substitution of traditional energy sources with renewable energy sources has emerged as a major solution tool (Yildirim, 2014). In this context, according to the optimistic scenario developed by the IEA, a 39% rise in electricity production from renewable sources by 2050 (with production by 18% in 2002) is expected. Thus, it is emphasized that 50% of global CO^2 emissions can be reduced and the increase in global temperature can be limited to the range of 2.0–2.4 °C. Therefore, renewable energy production and technologies have become the central element of the position of the energy policy. In recent years, production of renewable energy sources has been encouraged by state-funded subsidies, tax reduction and other support. These incentives reduced the production costs of renewable energy and in many countries renewable energy has become competitive with conventional energy. These developments have revealed many new entrepreneurs in the field of renewable energy throughout the world (Bhattacharya et al., 2016). The emerging trend in the global energy sector has led to a new debate about the role of the sustainable development of renewable energy sources (Lund, 2007; Sadorsky, 2009; Inglesi-Lotz, 2016). In terms of the outcomes of this discussion, it's important to understand the dynamics between renewable energy consumption and economic growth (Apergis and Payne, 2012). To date, a wide range of research area on the relationship between energy consumption and economic growth has occurred in the related literature (Ozturk, 2010; Sebri, 2015). However, studies based

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http://dx.doi.org/10.1016/j.enpol.2016.10.007
Received 7 June 2016; Accepted 7 October 2016
0301-4215/

on renewable energy in this area are limited. Therefore, renewable energy has created a large interest among both academics and policy analysts (Bhattacharya et al., 2016). This interest has been the motivation of our work. The aim of this study is to explore the relationship between renewable energy consumption and economic growth for Albania, Bulgaria, Georgia, Greece, Macedonia, Romania, Russia F., Turkey and Ukraine that compose nine Black Sea and Balkan countries in the period of 1990–2012. The literature contribution and importance of this work comes from three points:

First, countries and regions involved in the research are chosen purposely, not randomly. Yet, why have these nine countries been selected? Because, these nine countries in the Black Sea and the Balkan region have a population of 317.2 million and constitute production volume of 2129 billion dollars. Moreover, these countries produced a 1004,67 MTOE energy in 2013 and caused 2287,63 mt CO_2 emission. According to these data, these nine countries alone constitute 4.5% of world population, 3.8% of production (GDP), 7.7% of energy demands and 7.1% of CO_2 emission (IEA, 2015). For this reason, the outcomes of this study will provide valuable deductions for economic growth, energy security and global warming in both domestic and global level.

Second, in the literature, the dynamic relationship between economic growth and renewable energy is explained through a panel composed by choosing certain countries. However, this approach is criticized as the countries that compose the panel are largely heterogeneous (Bhattacharya et al., 2016). Taking this criticism into consideration, in this study causality relation between renewable energy consumption and economic growth will be explored using heterogeneous panel causality estimation techniques developed by Dumitrescu and Hurlin (2012). Thus, empirical evidence will be presented for both panel and individual countries.

Third, in the last few years, renewable energy-economic growth research field has been quite attractive especially by the availability of the renewable energy data (Sebri, 2015). The relationship between renewable energy and economic growth has been examined in a number of studies (Aslan and Ocal, 2016). However, as far as we know, it seems there is a research gap in the literature in terms of renewable energy and economic growth relationship in the Black Sea and Balkan countries (see Table 1). This study aims to fill in this gap in the literature.

In this frame, the rest of the paper is arranged as follows: Section 2 introduces literature on the renewable energy and economic growth relationship. Section 3 presents model and data. Section 4 describes econometric methodology. Section 5 yields estimation results, and Section 6 evaluates main findings and provides some policy suggestions.

Table 1
Literature on the relationship between renewable energy consumption and economic growth.

Author (s)	Country/Region	Period	Methodology	Conclusion
Payne (2009)	USA	1949–2006	Toda-Yamamoto	neutrality
Sadorsky (2009)	18 emerging countries	1994–2003	Panel cointegration, panel DOLS, panel FMOLS, panel VEC	conservation
Apergis and Payne (2010)	20 OECD countries	1985–2005	Panel cointegration, panel FMOLS, panel VEC	feedback
Menegaki (2011)	27 European countries	1997–2007	random effect	neutrality
Apergis and Payne (2011)	6 Central American countries	1980–2006	Panel cointegration, panel FMOLS, panel VEC	feedback
Tiwari (2011)	India	1960–2009	Structural VAR	conservation
Tugcu et al. (2012)	G7 countries	1980–2009	Cointegration and Hatemi-J causality	Mix results
Salim and Rafiq (2012)	6 major emerging economies	1980–2006	Panel cointegration, panel DOLS, panel FMOLS, Granger causality	feedback (short-run)
Apergis and Payne (2012)	80 countries	1990–2007	Panel cointegration, panel FMOLS, panel VEC	feedback
Pao and Fu (2013)	Brazil	1980–2010	cointegration and VEC	feedback
Ocal and Aslan (2013)	Turkey	1990–2010	Cointegration and Toda-Yamamoto	neutrality
Al-mulali et al. (2013)	High, upper-middle, lower middle and low income countries	Different periods	FMOLS	Feedback (79% of the countries) Neutrality (19% of the countries) Conservation (2% of the countries)
Lin and Moubarak (2014)	China	1977–2011	Cointegration and VEC	feedback
Al-mulali et al. (2014)	18 Latin American countries	1980–2010	Panel cointegration, panel DOLS, panel VEC	feedback
Bilgili (2015)	USA	1981–2013	wavelet coherence	growth
Shahbaz et al. (2015)	Pakistan	1972Q1–2011Q4	Cointegration and VEC	feedback
Dogan (2015)	Turkey	1990–2012	Cointegration and VEC	neutrality
Bilgili and Ozturk (2015)	G7 countries	1980–2009	Panel cointegration, panel OLS and panel DOLS	growth
Ozturk and Bilgili (2015)	51 Sub-Sahara African countries	1980–2009	Panel cointegration, panel OLS and panel DOLS	growth
Aslan and Ocal (2016)	New EU member 7 countries	1990–2009	Cointegration and Hatemi-J causality	Mix results
Shahbaz et al. (2016)	BRICS countries	1991Q1–2015Q4.	Panel cointegration, fixed effect and panel VEC	feedback
Inglesi-Lotz (2016)	34 OECD countries	1990–2010	Panel cointegration, fixed effect and pooled estimation	growth
Hamit-Haggar (2016)	11 Sub-Saharan African countries	1971–2007	Panel cointegration, OLS, DOLS, FMOLS, DSUR and bootstrap-corrected Granger	growth
Bhattacharya et al. (2016)	38 top renewable energy consuming countries	1991–2012	Panel cointegration, panel FMOLS, DOLS and Dumitrescu-Hurlin causality	renewable energy has a significant positive impact on the economic output (57% of the countries) neutrality (short-run)