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Are fluctuations in electricity consumption per capita transitory? Evidence from developed and developing economies

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ABSTRACT

This paper investigates the unit root properties of electricity consumption per capita of 67 developed and developing countries for the period 1971–2010. To examine the stationary properties of electricity consumption per capita, we have adopted Lee and Strazicich (2003, 2004) test of unit root that allows us to test for at most two endogenous breaks and uses the Lagrange Multiplier (LM) test statistics. Results show that 65 country series reject the unit root null hypothesis except for 2 country series. Thus, our empirical findings provide significant evidence that electricity consumption per capita is stationary in almost all countries considered. The stationarity of electricity consumption per capita indicates that it should be possible for the series to forecast future movements in the energy consumption based on the past behaviors of the series.

Contents

1. Introduction

Energy literature seems to provide the empirical evidence finding stationarity properties of energy consumption. For instance, Lee and Chang [1], Al-Irani [2], Chen and Lee [3], Narayan and Smyth [4], Hsu et al. [5], Lean and Smyth [6], Mishra et al. [7], Apergis et al. [8,9], Narayan et al. [10], Ozturk and Aslan [11], Hasanov and Telatar [12], Aslan [13], Aslan and Kum [14] and Kula et al. [15] applied numerous approaches to examine stationarity properties of energy consumption. The empirical investigation of stationarity properties of the energy consumption leads us to check whether shocks to energy consumption have unending or temporary effects. If the series of energy consumption is stationary at level then fluctuations in energy consumption will have temporary effects with the passage of time and such economic policies have transitory impact. These effects are removed once the series (i.e. energy consumption) return to their long run path. The past behavior of energy consumption can be used to formulate forecast once series is found to be stationary. On the contrary; if energy consumption contains a unit root problem (i.e. non-stationary) then fluctuations in energy consumption seem to have permanent effects (Chen and Lee, [3]; Mishra et al., [7]).

The studies reported in Table 1 applied various techniques to find stationarity properties of energy variables providing conflicting results. Most of these studies used unit root tests which do not have information about structural break point stemming in the energy series except Ozturk and Aslan [11] and Kula et al. [15]. These tests failed to capture the effects of continuous economic growth, implementation of national policies, crisis, wars etc, although authors employed a variety of econometric approaches. Thus, when structural breaks are taken into account, most of the studies show that electricity consumption per capita is stationary.

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Table 1
Survey of literature for stationarity properties.

Authors	Time period	Unit root test	Conclusion
Lee and Chang [1]	1954–2003	Zivot and Andrews [16] structural break test	Unit root exists
Al-Iriani [2]	1971–2002	Univariate and IPS panel tests	Unit root exists
Narayan and Smyth [4]	1979–2000	Univariate and IPS panel tests	Stationarity is found
Chen and Lee [3]	1971–2000	Carrion-Silvestre multiple Test	Stationarity is found
Narayan et al. [17]	1973–2008	LM structural break test	Stationarity is found
Hsu et al. [5]	1971–2003	Panel seemingly unrelated regressions ADF	Unit root exists
Mishra et al. [7]	1980–2005	LLC, IPS and Maddalae Wu (MW) panel tests and CIPS test	Miscellaneous results
Lean and Smyth [6]	1973–2008	Long memory test	Miscellaneous results
Narayan et al. [10]	1973–2007	Lee and Strazicich [18] two Structural break Test	Stationarity is found
Apergis et al. [8]	1982–2007	LM structural break test	Stationarity is found
Apergis et al. [9]	1980–2007	LM structural break test	Stationarity is found
Ozturk and Aslan [11]	1970–2006	Lee and Strazicich [18]) two Structural break Test	Stationarity is found
Hasanov and Telatar [12]	1980–2006	Non-linear Test by Kapetanios et al. [19]	Miscellaneous results
Aslan [11]	1960–2008	LM structural break test	Miscellaneous results
Aslan and Kum [14]	1970–2006	LM structural break test	Stationarity is found
Kula et al. [15]	1960–2005	LM structural break test	Stationarity is found

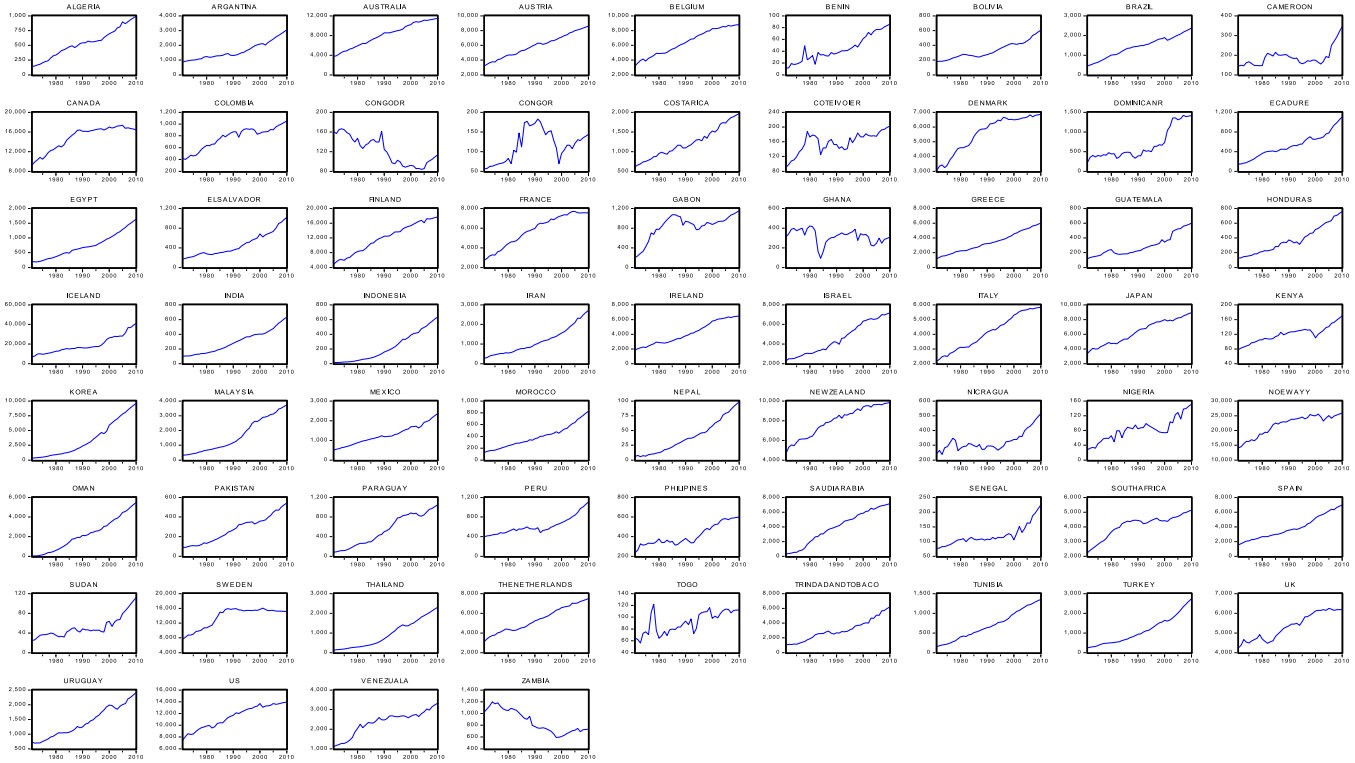

Fig. 1. Electricity consumption per capita in sample countries.

Finally, by taking structural breaks in the electricity consumption series will significantly increase the power of the unit root tests and more significant results may be obtained from the analyses.

The aim of this paper is to examine the unit root properties of electricity consumption per capita for the 67 developed and developing countries for 1971–2010 period (see Fig. 1). The paper is organized as follows: Section 2 describes methodology and data. Section 3 presents results and Section 4 concludes the paper.

2. Methodology and data

Traditional unit root tests like Augmented Dickey Fuller (ADF) [20], Phillips–Perron (PP) [21] and Perron [22] are found to give misleading results (i.e. biased towards the non-rejection of null hypothesis when structural breaks are present in the data series). Therefore, in the present study we have adopted Lee and Strazicich [18,23] test of unit root that allows us to test for at most two endogenous break and uses the Lagrange Multiplier (LM) test statistics. Let us consider the following data generating process (DGP):

$$y = \delta Z_t + e_t, \; e_t = \beta e_{t-1} + \varepsilon_t. \tag{1}$$

where Z_t is a vector of exogenous variables, δ is a vector of parameters and ε_t is a white noise process, such that $\varepsilon_t \sim NIID(0, \sigma^2)$. First we will consider the case where there is evidence of one structural break. The crash model that allows shift in level only is described by $Z_t = [1, t, D_t]'$, and the break model that allows for changes in both level and trend is described as