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Is energy consumption per capita stationary? Evidence from first and second generation panel unit root tests

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Abstract

The empirical investigation of unit root properties of energy variables is very important to test the energy-growth nexus. Testing unit root properties of energy consumptions helps policy makers to design adequate energy policies once they are aware of whether energy use is temporary or permanent. In this purpose, we have applied both first- and second-generation panel unit root tests on energy consumptions per capita in 103 countries with high-, middle- and low-income classification from 1971 to 2011. Our results indicate that energy consumptions per capita follow a stationary process in high- and middle-income countries, while it follows a unit root process in low-income countries. This suggests that short-run energy policies should be drawn to sustain economic growth and fulfill energy demands in high- and middle-income countries. However, in low-income countries, policy makers should draw long-term energy policies.

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1. Introduction

The objective of this paper is to investigate the stationarity properties of energy consumption per capita in 103 high-, middle- and low-income countries. We apply both first- and second-generation panel unit root tests for this purpose. It is very important for policy makers to know whether fluctuations in energy consumptions are transitory or permanent. If energy consumptions are found to be stationary then fluctuations are transitory. This will make long-run energy policies ineffective as energy consumptions will always return to its original path. As such, governing bodies should not set long-term goals in terms of energy consumptions. On the other hand, if energy consumptions follow a unit root process; its fluctuations will be permanent. In this case, the series will be stable with a path dependency. In turn, this path dependency implies that changes in energy markets will have permanent impacts on energy consumptions. In this case, long-term energy policies will be more effective. Furthermore, the distinction between temporary and permanent shocks to energy consumptions influences the modeling of energy demand and forecasting. Forecasts of energy consumptions play a vital role in formulating energy policies. Safe and efficient energy supply for economic growth can be possible only with reliable forecasts. If the series is stationary, then the past behavior has a role to play in the generation of forecasts. On the other hand, if the series is non-stationary, then the past behavior serves little or has no use in forecasting. Finally, the distinction between transitory or permanent shocks in energy consumptions is also very important to model the relationship between energy consumptions and economic growth.

The current study extends the existing literature on this topic in various ways. First, we use a large panel data set (103 countries) with a long time period (1971-2011) in order to increase the sample size.[1] Second, we divide our sample into three groups in function of the income level (high, middle and low). Third, we apply both first- and second-generation panel unit root tests. The first-generation panel unit root tests ignore the cross-sectional dependence, while the second-generation ones take this feature into account. Therefore, by using such a battery of panel unit root tests, we are able to investigate adequately the unit root property of energy consumptions. Finally, we also use a nonlinear panel unit root test developed by Chang (2002) to take into account the nonlinearity of energy consumptions.

The rest of the paper is organized as follows. Section 2 presents the literature review on the unit root property of energy consumptions. Section 3 details the methodology used while Section 4 analyzes the results. Section 5 concludes the paper.

2. Literature review

The empirical investigation of the existence of unit root in energy consumptions has become a field of interest for economists and researchers in recent years. Soytas and Sari (2003) and Lee (2005) report the unit root problem in energy consumptions per capita in Turkey and developing economies. However, the evidence of non-stationarity in these countries is due to the abrupt use of low-power tests using small sample data (Narayan and Smyth 2007, Chen and Lee 2007 and Hsu *et al.* 2008). This opened a new direction for researchers to find appropriate unit root tests (Hasanov and Telatar 2011). Narayan and Smyth (2007) bases on data from 182 countries to increase the number of observations and thus the power of tests. They apply the ADF unit root test and find stationarity in 56 countries. On the other hand, the panel unit root test, developed by Im *et al.* (2003), rejects the hypothesis of non-stationarity. Chen and Lee (2007) apply the Carrion-i-Silvestre *et al.* (2005) unit root test and find that the unit root problem does not exist in energy consumptions per capita.[2] In the case of 13 Pacific Island countries, Mishra *et al.* (2009)

also apply the panel unit root test developed by Carrion-i-Silvestre *et al.* (2005). Taking into account multiple structural breaks at unknown dates, they find stationarity in 8 out of 13 countries. For the five remaining countries, they point out that there exists unit root problem due to the high volatility in energy consumptions.

Furthermore, the conventional unit root tests are also criticized due to their misinterpretation of the null hypothesis in panel data, as pointed out by Breuer *et al.* (2001). Indeed, Breuer *et al.* (2001) reinvestigate the unit root properties of energy consumptions per capita for 84 countries. They separate these countries into five regions. Their results indicate that in most regions, energy consumptions have unit root problem. Hasanov and Telatar (2011) probe the unit root property of energy consumptions and primary energy consumptions using data from 178 countries. They apply a conventional unit root test, a nonlinear test developed by Kapetanios *et al.* (2003), and also a structural break test developed by Sollis (2004). They find that nonlinear and structural break unit root tests accept the hypothesis of stationarity in most cases.

To the best of our knowledge, existing studies investigating the unit root property of energy consumptions only use the first-generation panel unit root tests, without incorporating structural breaks. These studies are Narayan and Smyth (2007), Chen and Lee (2007), Hsu *et al.* (2008), Narayan *et al.* (2008), Apergis *et al.* (2010a, b), Agnolucci and Venn (2011), Narayan and Pop (2012), etc. The methods used in these studies are unit root tests proposed by Im *et al.* (2003), Levin *et al.* (2002), Breitung (2000), Hadri (2000), and Maddala and Wu (1999). These first-generation panel unit root tests are criticized for various reasons. For example, homogeneous unit root tests (such as that of Levin *et al.* 2002, Breitung 2000 and Hadri 2000) follow the restrictive hypothesis of stationarity process with the AR(1) estimate. Agnolucci and Venn (2011) report that it is difficult to know which series contains a stationary process when applying heterogeneous unit root tests, such as those proposed by Im *et al.* (2003) and Maddala and Wu (1999). Furthermore, these unit root tests seem to ignore the cross-sectional dependence.[3] Our study thus extends the existent literature in applying not only the first-generation panel unit root tests, but also the second one that takes into account the cross-sectional dependence. These tests are detailed in the next section.

II. First- and second-generation panel unit root tests

Following Breitung and Pesaran (2008) and Baltagi (2005), we use panel data analyses in order to increase the power of unit root tests. We divide these tests in two groups, namely 'first-generation panel unit root tests' and 'second-generation panel unit root tests'. The first-generation tests applied in this study are: LLC test (Levin *et al.* 2002), IPS test (Im *et al.* 2003) and MW test (Maddala and Wu 1999). The second-generation tests used are: MP test (Moon and Perron 2004), Pesaran test (Pesaran 2007) and Choi test (Choi 2006). The main difference between these two generations of tests lies in the cross-sectional independence assumption. First-generation tests assume that all cross-sections are independent and second-generation tests relax this assumption. Details of the tests used in our study are presented below.

First-generation panel unit root tests: LLC, IPS, and MW

The LLC test (Levin *et al.* 2002) employs the following adjusted t-statistic:

$$t_{\partial}^{*} = \frac{t_{\alpha} - (NT)\hat{S}_{N}\sigma_{\tilde{\varepsilon}}^{-2}\sigma_{\hat{\alpha}}\mu_{T}^{*}}{\sigma_{T}^{*}} \tag{1}$$

where $\hat{S}_N$ is the average of individual ratios between long-run and short-run variances for country *i*; $\sigma_{\tilde{\varepsilon}}$ is the standard deviation of the error term in equation (2); $\sigma_{\hat{\alpha}}$ is the standard deviation of the slope coefficients in equation (2); σ_T^* is the standard deviation adjustment; μ_T^* is the mean adjustment.

The IPS test (Im *et al.* 2003) employs a standardized *t*_bar statistic that is based on the movement of the Dickey–Fuller distribution:

$$Z_{t\_bar} = \frac{\sqrt{N}\{t\_bar - N^{-1}\sum_{i=1}^{N} E(t_{iT})\}}{\sqrt{N^{-1}\sum_{i=1}^{N} Var(t_{iT_i})}} \tag{2}$$

where $E(t_{iT})$ is the expected mean of $E(t_{iT})$, and $Var(t_{iT_i})$ is the variance of t_{iT}.

The MW test (Maddala and Wu 1999) is based on the combined significance levels (*p*-values) from the individual unit root tests. According to Maddala and Wu (1999), if the test statistics are continuous, the significance levels π_i (i =1, 2, …. N) are independent and uniform (0,1) variables. The MW test uses combined *p*-values, or P_{MW}, which can be expressed as:

$$P_{MW} = -2\sum_{i=1}^{N} \log \pi_i \tag{3}$$

where $-2\sum\log\pi_i$ has a χ^2 distribution with 2N degrees of freedom. Furthermore, Choi (2006) suggests the following standardized statistic:

$$Z_{MW} = \frac{\sqrt{N}\{N^{-1}P_{MW} - E[-2\log(\pi_i)]\}}{\sqrt{Var[-2\log(\pi_i)]}} \tag{4}$$

Under the cross-sectional independence assumption, this statistic converges to a standard normal distribution (Hurlin 2004).

Second-generation panel unit root tests: MP and Choi

Among the second-generation unit root tests, we use the MP test (Moon and Perron 2004), Pesaran test (Pesaran 2007) and Choi test (Choi 2006). Moon and Perron (2004) uses a factor structure to model cross-sectional dependence. Their model assumes that error terms are generated by common factors and idiosyncratic shocks.

$$y_{it} = \alpha_i + y_{it}^0 \tag{5}$$

$$y_{it}^0 = \rho_i y_{it-1}^0 + \upsilon_{it} \tag{6}$$

$$\upsilon_{it} = \lambda_i' F_t + e_{it} \tag{7}$$

where F_t is a $r \times 1$ vector of common factors and λ_i is a vector of factor loadings. The idiosyncratic component e_{it} is assumed to be *iid* across *i* and over *t*. The null hypothesis corresponds to the unit root hypothesis $H_0 : \rho_i = 1$ where *i* = 1,…,N; whereas under the alternative, variable y_{it} is stationary for at least one cross-sectional unit. For testing, the data are de-factored and then the panel unit root test statistics based on de-factored data are proposed.

Moon and Perron (2004) define two modified t-statistics, which have a standard normal distribution under the null hypothesis:

$$t_\alpha = \frac{T\sqrt{N}\left(\rho^+_{pool} - 1\right)}{\sqrt{2\gamma_e^4 / w_e^4}} \underset{T,N\to\infty}{\overset{d}{\to}} N(0,1) \tag{8}$$

$$t_b = T\sqrt{N}\left(\rho^+_{pool} - 1\right)\sqrt{\frac{1}{NT^2} trace(Z_{-1} Q_\wedge Z_{-1}^{'}) \frac{w_e^2}{\gamma_e^4}} \underset{T,N\to\infty}{\overset{d}{\to}} N(0,1) \tag{9}$$

where ρ^+_{pool} is the modified pooled OLS estimator using the de-factored panel data, w_e^2 denotes the cross-sectional average of the long-run variances $w_{e_i}^2$ of residuals e_{it} and γ_e^4 denotes the cross-sectional average of $w_{e_i}^4$. Moon and Perron (2004) propose feasible statistics t_α^* and t_b^* based on an estimator of the projection matrix and estimators of long-run variances $w_{e_i}^2$.

The Pesaran (2007) test uses cross-sectional augmented ADF statistics, denoted as CADF, which are given below:

$$\Delta y_{i,t} = \alpha_i + b_i y_{i,t-1} + c_i \bar{y}_{t-1} + d_i \Delta \bar{y}_i + e_{i,t} \tag{10}$$

where a_i, b_i, c_i, and d_i are slope coefficients estimated from the ADF test in country *I*, $\bar{y}_{t-1}$ is the mean value of lagged levels, and $\Delta\bar{y}_i$ is the mean value of first differences; $e_{i,t}$ is the error term.

Pesaran (2007) suggested modified IPS statistics based on the average of individual CADF, which is denoted as a cross-sectional augmented IPS (CIPS). This is estimated from:

$$CIPS = \frac{1}{N}\sum_{i=1}^{N} t_i(N, T) \tag{11}$$

where *t* (*N*, *T*) is the t-statistic of the OLS estimate in equation (11).

Based on the Dickey-Fuller-GLS statistic (Elliott *et al.* 1996), Choi (2006) suggests the following Fisher's type statistics:

$$P_m = -\frac{1}{\sqrt{N}}\sum_{i=1}^{N}[\ln(P_i) + 1] \tag{12}$$

$$Z = \frac{1}{\sqrt{N}}\sum_{i=1}^{N}\Phi^{-1}(P_i) \tag{13}$$

$$L^* = \frac{1}{\sqrt{\pi^2 N / 3}}\sum_{i=1}^{N}\ln(P_i / 1 - P_i) \tag{14}$$

where P_i is the asymptotic p-values of the Dickey-Fuller-GLS statistic for country *I*, $\Phi(\cdot)$ is the cumulative distribution of a standard normal variable.

3. Data and definition of variables

We use annual data on energy consumptions per capita (kt of oil equivalent) of 103 countries. The data are collected from World Development Indicators (CD-ROM 2013). The sample countries are listed in Table 1 following their income levels (high, middle or low). Figures 1, 2 and 3 present their evolution over the 1971-2011 period, respectively.

Insert Table 1 here

Insert Figures 1, 2 and 3 here

4. Empirical results

Primarily, we apply several tests to check the existence of cross-sectional dependence (the null hypothesis). This allows us to know whether first- or second-generation panel unit root tests are better for our sample panel data. The results are reported in Table 2. We find that all tests reject H_0 (with both Frees 1995, Friedman 1937 and Pesaran 2004 tests). In the presence of cross-section dependence, second-generation panel unit root tests are better for the whole panel data as well as sub-groups of panels (high-, middle- and low-income countries).

Insert Table 2 here

In the next step, we employ both first- and second-generation tests presented in Section 3 for 103 countries, high-income countries panel, middle-income countries panel, and low-income countries panel. This allows us to compare the results of the two generations of tests. The results are reported in Table 3.

Insert Table 3 here

First, we will discuss the results of first-generation panel unit root tests. The LLC test provides evidence to reject the null hypothesis which reveals that energy consumptions per capita contain a unit root for the whole panel of 103 countries at the 1% significance level. The results of IPS tests provide evidences to reject the null hypothesis of unit root for the entire panel of 103 countries at 10% significance level, high-income group countries at 5%, middle-income countries and low-income countries at 10%. Hence, only the levels of significance for IPS and LLC test are different. The MW test (Maddala and Wu 1999) rejects the null hypothesis of unit root for the entire panel of 103 countries, and high-income countries at 1%, middle-income countries at 10% and for low-income countries, the null hypothesis is not rejected.

As for second-generation unit root tests, the first and second MP tests[4] show stationarity for the entire panel, and all sub-group countries at 1% level of significance. However, the CIPS test (Pesaran 2007) rejects the null hypothesis of unit root for 103 countries at 10% level of significance and for high-income countries at 1%. For other groups of countries, the null hypothesis of unit root is not rejected. As for the Choi (2006) tests, Choi's first, second and third tests[5] reject the null hypothesis of unit root for the entire panel of 103 countries as well as for high-income countries. For middle-income countries, the Choi's first test rejects the null at 1% level of significance; the third test rejects at 10% while the second test does not reject the null hypothesis of unit root. For low-income countries, none of the Choi's test rejects the null hypothesis. Finally, we find very contrary results from Chang (2002) IV test which provides no evidence to reject the null hypothesis of unit root for either the total group of countries or the sub-groups of countries. The differences in the results regarding the unit root property are related to different kinds of tests. First-generation tests do not take into account the cross-sectional dependence while the second-generation ones can do it. The Chang (2002) IV test takes the nonlinearity into account. In the context of our sample data, we choose to base on second-generation tests since we find the existence of cross-sectional dependence (see Table 2). These differences also show that one should choose carefully unit root tests that correspond to the characteristics of the series understudy.

Finally, following the results of second-generation unit root tests, we notice that energy consumptions per capita are stationary in high-income countries, according to all the three tests. As for middle-income countries, it is stationary in most cases (following two over three tests, MP and Choi tests). For low-income countries, the situation is reversed since the unit root hypothesis is not rejected in two over three tests (CIPS and Choi tests). These results suggest that in high-and middle-income countries, energy consumptions are stationary and thus transitory; while in low-income countries, its fluctuations are permanent. This implies that energy consumptions can be forecasted based on past behaviors in high- and middle-income countries while it is not the case in low-income countries.

5. Conclusion and policy implications

The empirical testing of unit root properties of energy consumptions per capita is necessary to know the behaviour of business cycles. Furthermore, it would also help to understand long-run and short-run impacts of macroeconomic policies on energy consumptions. We have used a battery of panel unit root tests to know the stationary property of energy consumptions per capita in 103 countries. We have distinguished between three groups of countries with high income, middle income and low income. We have applied both first-generation and second-generation panel unit root tests over the 1971-2011 period.

To take into account the cross-sectional dependence that exists in our sample series, we only focus on the results of second-generation unit root tests (MP, CIPS and Choi tests). These results show significant differences between two groups of countries: high- and middle-income countries on the one side, and low-income countries on the other side. For the first group, energy consumptions are stationary while for the second group, it follows a unit root process. These findings can have some practical implications for econometric modelling as well as for policy makers in formulating energy policies to sustain the economic growth. The stationarity of energy consumptions around a deterministic time trend[6] in high- and middle-income countries suggests that the series have transitory effects and thus innovations in energy markets will have a transitory effect on energy consumptions. In such environment, governing bodies should not implement long-run redundant goals in terms of energy consumptions. However, policy makers can use its past behaviors to forecast energy demands in the future to sustain economic growth. For low-income countries, the situation is different since energy consumptions per capita follow a unit root process. This implies that its fluctuations will be permanent and thus energy policies can have permanent impacts on energy consumptions. In this case, policy makers in low-income countries should better draw long-term energy policies.

Footnotes

1. This study uses longer time series than Narayan and Smyth (2007) that uses a sample of 182 countries. We convert energy consumption series into logarithm for all countries following Shahbaz and Lean (2012a,b).
2. Chen and Lee (2007) also reject the hypothesis of unit root in energy consumptions for 104 countries by applying panel unit root tests.
3. Agnolucci and Venn (2011) argue that first-generation panel unit root tests may provide biased results because they do not contain information about structural breaks in the time series.
4. Note that Moon and Perron (2004) develop two unit root tests that are referred to as first and second MP test.
5. Note that Choi (2006) gives three test statistics for the testing of unit root. We refer to them as the first, second and third Choi tests.
6. A deterministic time trend is a path around which the stationary series evolve.

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Appendix

Table 1: List of sample countries

High income countries	Middle income countries	Low income countries
Australia, Austria, Belgium, Brunei Darussalam, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Nicaragua, Norway, Oman, Poland, Portugal, Qatar, Saudi Arabia, Singapore, Slovak Republic, Spain, Sweden, Switzerland, Trinidad and Tobago, UAE, UK, US	Albania, Algeria, Angola, Argentina, Bolivia, Brazil, Bulgaria, Cameroon, Chili, China, Colombia, Congo Rep. Costa Rica, Ivory Coast, Cuba, Dominican Rep. Ecuador, Egypt, El Salvador, Gabon, Guatemala, Honduras, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Lebanon, Libya, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Romania, Senegal, South Africa, Sri Lanka, Sudan, Syria, Thailand, Tunisia, Turkey, Uruguay, Venezuela Rep. Vietnam, Yamane Rep. Zambia	Bangladesh, Benin, Congo Dem Rep. Ethiopia, Haiti, Kenya, Korea Dem Rep. Malta, Mozambique, Myanmar, Nepal, Tanzania, Togo and Zimbabwe

Figure 1: Energy consumptions in high-income countries

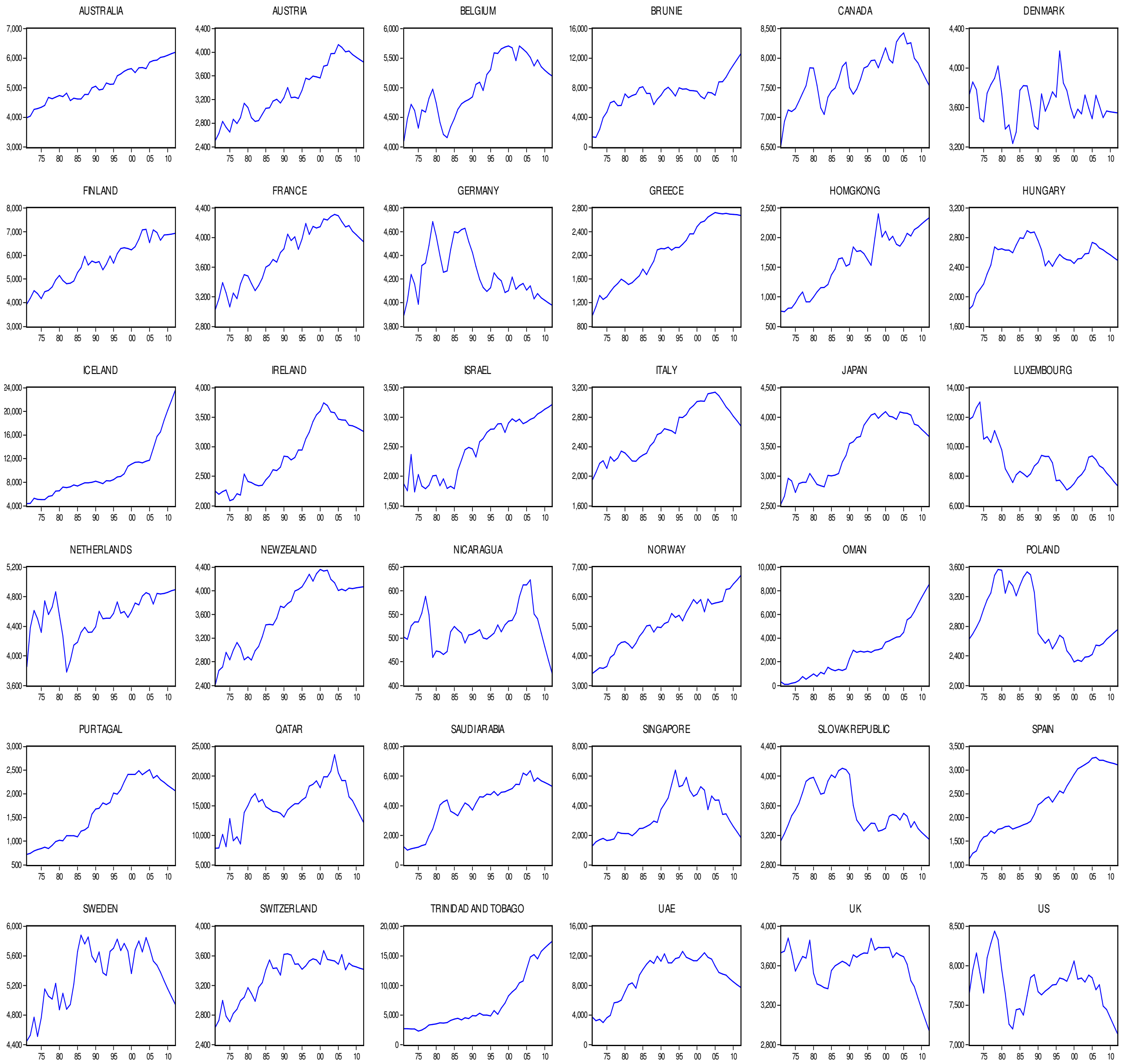

Figure 2: Energy consumptions in middle-income countries

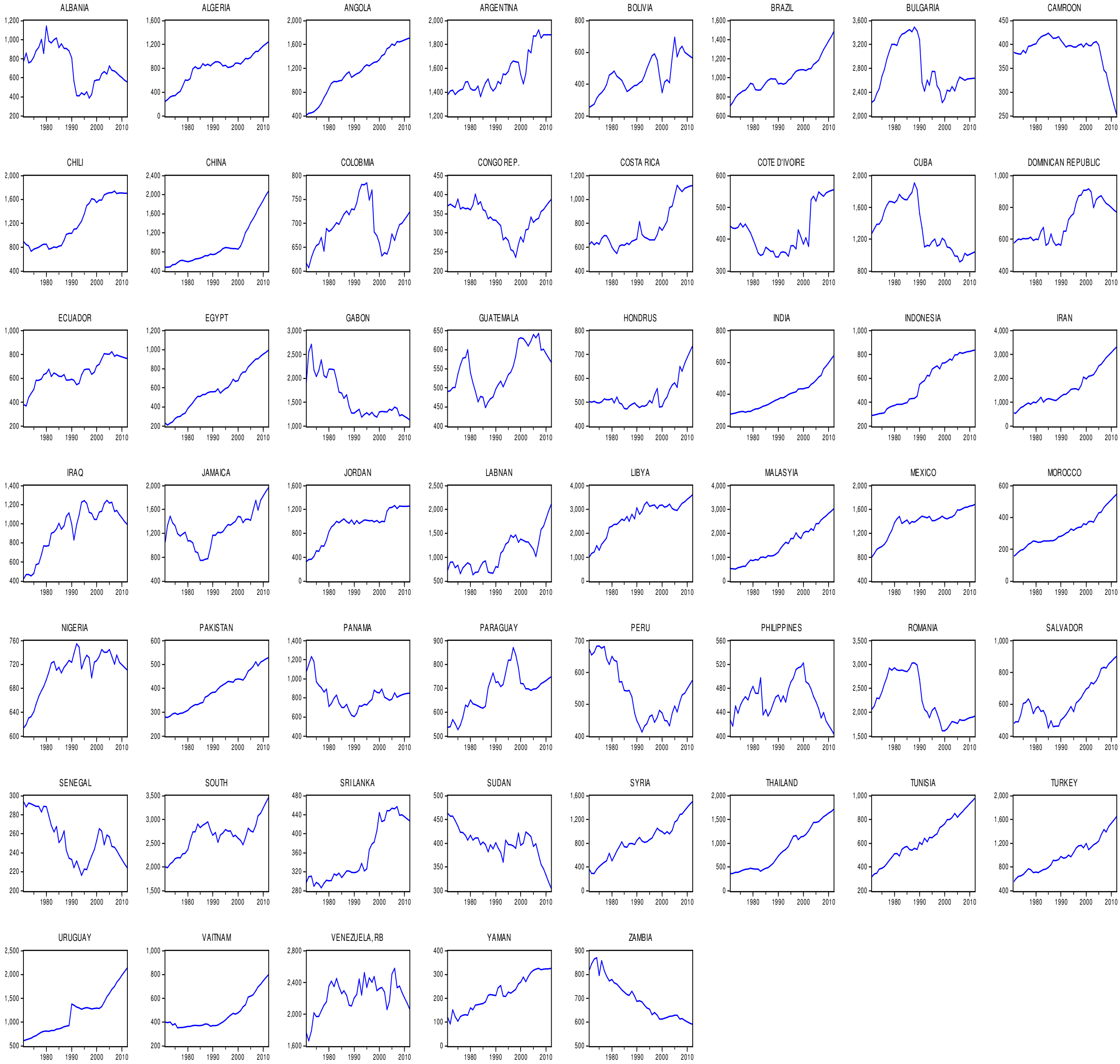

Figure 3: Energy consumptions in low-income countries

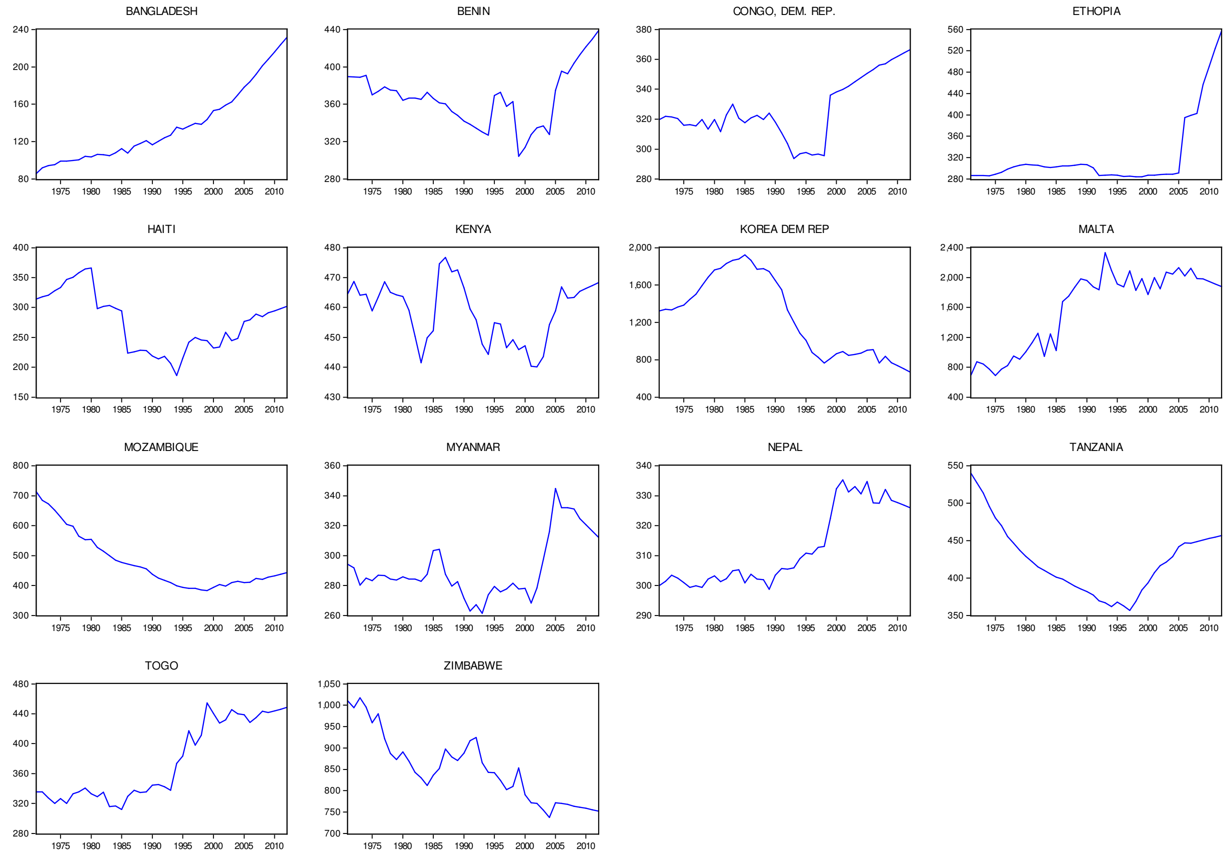

Table 2: Cross-sectional dependence tests

Cross sectional dependence test	Panel data form			
	Full panel	**High**	**Low**	**Medium**
Frees' test of cross sectional independence (p-value)	38.449 (0.0000)	14.921 (0.0000)	3.139 (0.0000)	20.983 (0.0000)
Friedman's test of cross sectional independence (p-value)	883.532 (0.0000)	575.691 (0.0000)	63.357 (0.0000)	488.511 (0.0000)
Pesaran's test of cross sectional independence (p-value)	105.791 (0.0000)	68.069 (0.0000)	4.616 (0.0000)	55.856 (0.0000)

Notes: Frees (1995), Friedman (1937) and Pesaran (2004) cross-sectional dependence tests are used.

Table 3: Unit root tests

First Generation of Panel Unit Root Tests: *Full panel*				
Types of test statistic	*Test statistic*	*1 % CV*	*5 % CV*	*10 % CV*
LLC test statistic computed in equation (1)	-6.4291	-2.3263	-1.6449	-1.2816
IPS test statistic computed in equation (2)	-1.5869	-2.3263	-1.6449	-1.2816
MW test statistic computed in equation (3)	254.6696	253.9083	238.3220	230.2765
Choi test statistic computed in equation (4)	2.5085	2.3263	1.6449	1.2816
Second-generation panel unit root tests: *Full panel*				
Moon Perron1 computed in equation (8)	-18.4725	-2.3263	-1.6449	-1.2816
Moon Perron2 computed in equation (9)	-18.4113	-2.3263	-1.6449	-1.2816
Pesaran test (2007) computed in equation (11)	-2.0154	-2.1633	-2.0718	-2.0119
Choi test statistic computed in equation (12)	5.6204	2.3263	1.6449	1.2816
Choi test statistic computed in equation (13)	-3.0707	-2.3263	-1.6449	-1.2816
Choi test statistic computed in equation (14)	-3.5550	-2.3263	-1.6449	-1.2816
Chang (2002) IV (SN2) test	15.4776	-2.3263	-1.6449	-1.2816
First Generation of Panel Unit Root Tests: *High-income panel*				
LLC test statistic computed in equation (1)	-5.4270	-2.3263	-1.6449	-1.2816
IPS test statistic computed in equation (2)	-2.0263	-2.3263	-1.6449	-1.2816
MW test statistic computed in equation (3)	104.8359	100.4252	90.5312	85.5270
Choi test statistic computed in equation (4)	2.9442	2.3263	1.6449	1.2816
Second-generation panel unit root tests: *High-income panel*				
Moon Perron1 computed in equation (8)	-13.9850	-2.3263	-1.6449	-1.2816
Moon Perron2 computed in equation (9)	-14.4221	-2.3263	-1.6449	-1.2816
Pesaran test (2007) computed in equation (11)	-2.5202	-2.2974	-2.1503	-2.0721
Choi test statistic computed in equation (12)	6.7115	2.3263	1.6449	1.2816
Choi test statistic computed in equation (13)	-4.2756	-2.3263	-1.6449	-1.2816
Choi test statistic computed in equation (14)	-4.8388	-2.3263	-1.6449	-1.2816
Chang (2002) IV (SN2) test	8.7152	-2.3263	-1.6449	-1.2816
First Generation of Panel Unit Root Tests: *Low-income panel*				
LLC test statistic computed in equation (1)	-3.2224	-2.3263	-1.6449	-1.2816
IPS test statistic computed in equation (2)	-1.3330	-2.3263	-1.6449	-1.2816
MW test statistic computed in equation (3)	21.9104	45.6417	38.8851	35.5632
Choi test statistic computed in equation (4)	-0.5671	2.3263	1.6449	1.2816
Second-generation panel unit root tests: *Low-income panel*				
Moon Perron1 computed in equation (8)	-5.6844	-2.3263	-1.6449	-1.2816
Moon Perron2 computed in equation (9)	-5.5871	-2.3263	-1.6449	-1.2816
Pesaran test (2007) computed in equation (11)	-1.4441	-2.4753	-2.2478	-2.1415
Choi test statistic computed in equation (12)	-0.0826	2.3263	1.6449	1.2816
Choi test statistic computed in equation (13)	-0.1697	-2.3263	-1.6449	-1.2816
Choi test statistic computed in equation (14)	-0.1738	-2.3263	-1.6449	-1.2816
Chang (2002) IV (SN2) test	3.0099	-2.3263	-1.6449	-1.2816

First Generation of Panel Unit Root Tests: *Middle-income panel*				
LLC test statistic computed in equation (1)	-4.2311	-2.3263	-1.6449	-1.2816
IPS test statistic computed in equation (2)	-1.4569	-2.3263	-1.6449	-1.2816
MW test statistic computed in equation (3)	127.6132	140.4590	128.8039	122.8580
Choi test statistic computed in equation (4)	1.6373	2.3263	1.6449	1.2816
Second-generation panel unit root tests: *Middle-income panel*				
Moon Perron1 computed in equation (8)	-19.9559	-2.3263	-1.6449	-1.2816
Moon Perron2 computed in equation (9)	-19.6606	-2.3263	-1.6449	-1.2816
Pesaran test (2007) computed in equation (11)	-1.9453	-2.2372	-2.1135	-2.0405
Choi test statistic computed in equation (12)	2.5761	2.3263	1.6449	1.2816
Choi test statistic computed in equation (13)	-1.0751	-2.3263	-1.6449	-1.2816
Choi test statistic computed in equation (14)	-1.3536	-2.3263	-1.6449	-1.2816
Chang (2002) IV (SN2) test	12.3269	-2.3263	-1.6449	-1.2816