Is Per Capita Real GDP Stationary? Evidence from OPEC Countries

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Abstract

This paper examines the stationarity of per capita GDP of a panel of OPEC countries during the period 2000 to 2012. By considering the subsequent power advantages of panel data unit root tests, we employ Im, Pesaran and Shin (2003) test. The empirical results indicate that real GDP per capita series among OPEC countries are nonstationary. The nonstationarity properties of OPEC countries were strongly inconsistent with the idea that business cycles have stationary fluctuations around a deterministic trend. This means that oil price shocks would possibly permanently affect the real output levels of OPEC countries.

Keywords: Real GDP per capita, Stationary, Panel Unit root tests

1. Introduction

In macroeconomic literature both Neo-Keynesian and Monetarist economists believe that the business cycles are a transitory phenomena, and output returns to its natural rate in long run. However, Nelson and Plosser (1982) argue that a unit root in real output is inconsistent with the notion that business cycles are a transitory event , this means that shocks to real output have permanent effects on the economic process. The stationary real per capita GDP in a given economy implies that business cycles are stationary fluctuations around a deterministic trend.

Since Per capita real gross domestic product is an important macroeconomic variable for analyzing the impact of economic policies, it is essential to determine statistically whether the real Per capita gross domestic product series has a unit root or nonstationary. The modelling of real output levels as either a trend stationary or a difference stationary process has important implications for macroeconomic policy making, modelling, testing and forecasting (Nelson and Plosser ,1982; Chang et al, 2006). Accordingly, not only empirical researchers but also policymakers are paying attention to studies on this issue.

It is believed that the economics of oil exporting countries is remarkably related to oil revenues. In this way, the economic activity of these countries is affected by the shocks from international oil price fluctuations. Since the economic process of OPEC countries is subject to oil prices shocks, the detection of the nature of shocks (Permanent or temporary) is crucial in designing appropriate economic policies in these countries.

The remainder of this study is organized as follows. Section 2 describes the methodology of research. Section 3 presents the data used in our study and discusses the empirical findings. Finally, Section 4 reviews the conclusions.

2. Literature Review

Following initial study by Nelson and Plosser (1982), many studies examined the time series properties of the macroeconomic variables by using different unit root tests. Empirical results from Stock and Watson (1986); Perron and Phillips (1987); Nelson and Murray (2000) studies provide evidence of unit root in US real GDP.

Rapach (2002) finds robust evidence against the stationarity of real GDP using four different panel unit root tests using both postwar data and data covering most of the 20th century. Narayan (2008) apply ADF and KPSS univariate tests without structural breaks for 15 Asian countries. His findings show that real per capita of these countries has unit root in level. Employing nonlinear univariate unit root test developed by kapetanios et al. (2003) Murthy and Anoruo (2009) study the per capita real GDP time series in 27 African countries over the period from 1960 to 2007. Their findings show that one-third of the countries, the series are stationary with nonlinear mean reversion that is nonlinear stationary. The per capita GDP of a panel of 17 Asian countries have been examined by Tiwari et al (2012). Empirical results from various panel unit root test reveal stationarity of per capita GDP for the entire Asian panel, as well as the East Asian and High Income Asian sub-panels. Real per capita GDP series of SAARC Countries has been examined by Tiwari et al (2012). Empirical results from employing various unit root test provide evidence of nonlinear stationarity in the series.

While empirical studies on the stationarity of real Per GDP is abundant in developing and developed countries, to the best of our knowledge there is no study in case of OPEC countries in the context of analyzing the stationary property of the per capita GDP. This empirical study contributes to this line of research by determining whether or not unit root process of the real GDP per capita of OPEC countries using the panel unit root test.

2. Methodology

From econometrics point of view, the unit root test is common approach to detect stochastic properties of time series data. Given the availability of shorter univariate time series data, the power of the unit root tests can be increased by the use of panel data (Breitung and Pesaran, 2008; Baltagi, 2005). The panel unit root approaches possess more power than univariate time series tests. These tests have been successful in finding evidence of stationarity that cannot be found by univariate methods. In order to examine the stationarity of per capita GDP of a panel of OPEC countries, we employ recently panel unit root test developed by Im, Pesaran, and Shin (2003). The IPS test allow for individual unit root processes so that the persistence parameters may vary across cross-sections. The test is characterized by the combining of individual unit root tests to derive a panel-specific result.

Im, Pesaran, and Shin begin by specifying a separate ADF regression for each cross section:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{it-j} + X'_{it}\delta + \varepsilon_{it} \qquad (1)$$

The null hypothesis may be written as,

$$H_0 : \alpha_i = 0, \qquad for \quad All \quad i \qquad (2)$$

while the alternative hypothesis is given by:

$$H_1 \begin{cases} \alpha_i = 0 & for \quad i = 1, 2, ..., \quad N_1 \\ \alpha_i \subset 0 & for \quad i = N+1, N+2, ..., \quad N \end{cases} \qquad (3)$$

(where the *i* may be reordered as necessary) which may be interpreted as a non-zero fraction of the individual processes is stationary.

After estimating the separate ADF regressions, the average of the *t-statistics* for α_i from the individual ADF regressions, $t_{iT_1}(p_i)$:

$$\overline{t_{NT}} = \left(\sum_{i=1}^{N} t_{iT_i}(p_i) \right) / N \qquad (4)$$

is then adjusted to arrive at the desired test statistics. The IPS (2003) test allows α being heterogeneous.

3. Data and Empirical Results

This empirical research is based on yearly real per capita real GDP data for twelve OPEC countries, namely Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela for the period 2000 to 2012. All the data were converted into natural logarithmic form before the empirical analysis. The source of the data is from world development indicator (WDI) database.

We have conducted the IPS panel unit root test. The IPS test is based on the null hypothesis that a unit root exists in any of the series in the panel. This panel unit root test is performed on the level and first difference of variable. The model without trend and with trend is adopted in the empirical analysis. Optimal lag lengths for IPS were chosen by Schwarz Information Criterion (SIC).

The IPS panel unit root test result is reported in Table 1. According to the test results, IPS test doesn't reject the unit root null, which indicates that real per capita GDP series are nonstationary for the two models (with and without trend).

Table2. Results of IPS Panel Unit Root Test

	Individual intercept		Individual intercept and trend	
	statistic	Probability	statistic	Probability
level	0.06495	0.5259	-1.1829	0.1184
First difference	-5.1790	0.0000	-4.3042	0.0000

4. Conclusions

The main aim of this paper is to examine the stationarity of real per capita GDP for the 27 OPEC countries using a recent panel unit root test. We apply the test advocated by Im, Pesaran and Shin (2003). The empirical results indicate that real per capita GDP series among OPEC countries are nonstationary. Our results are inconsistent with the view that business cycles are stationary fluctuations around a deterministic trend as the panel unit root test rejects the null hypothesis of unit root. These results also imply that shocks will have permanent effect on real per capita GDP for the OPEC countries. This means that oil price shocks would possibly permanently affect the real output levels of OPEC countries. In this circumstances, fiscal and/or monetary or any other stabilization policies would have permanent effects on the real output levels of OPEC countries. Our findings have notable implications in designing and implementing macroeconomics polices in OPEC countries.

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