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ARE OUTPUT FLUCTUATIONS TRANSITORY IN THE MENA REGION?

This study analyzes the nonstationarity of per capita real GDP for 11 Middle East and North Africa (MENA) Countries over the period 1970 to 2012 using two recently developed methods. SURADF and CADF panel unit root tests allowing for cross sectional dependence are used to determine whether output fluctuations are permanent or transitory. Contrary to the traditional view of business cycle, we find econometric evidence supporting the idea that the output fluctuations in MENA region are mostly permanent. These results also emphasize that the effectiveness of stabilization policies aimed at real output by the government should be reviewed to achieve long-lasting results.

Keywords: Panel unit root tests, MENA region, SURADF, CADF, output fluctuations

1. Introduction

Free market economy assumes that production, trade and economic activity fluctuate in short-run. These fluctuations illustrate a curved path around a long-run deterministic trend what is commonly called "business cycle". Many conventional views on business cycle assume that the fluctuations in output are generally

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driven by shocks to aggregate demand originating from monetary policy and fiscal policies. These traditional views also assume that the fluctuations in the aggregate demand have only a temporary effect on output, so that in the long-run the economy returns to its natural rate of output (Campbell and Mankiw, 1987). However, in their studies Campbell and Mankiw (1987) and Nelson and Plosser (1982) show that one cannot always illustrate graph of real GDP around a long-run deterministic trend line. According to econometric evidence of these studies, in the short-run the fluctuations in real GDP is different from a random walk with drift. Therefore, the long-run estimation results suggest that the shocks given to the GDP are largely permanent rather than transitory. Therefore, contrary to the conventional view of business cycle, they found that the fluctuations in real output represent a permanent deviation from its natural rate of output. In this regard, the macroeconomic research question discussed in this study and the purpose of this study is also to question this conventional view using newly developed panel data estimation techniques.

The empirical findings of these earlier studies conducted by Campbell and Mankiw (1987) and Nelson and Plosser (1982) have been supported by many authors by finding a unit root in real output using univariate time series tests like Augmented- Dickey Fuller (ADF) (1979) and conventional panel unit root tests like LLC (2002), IPS (2002) and Hadri (2000). However, these tests assume that cross sections are independent; they are not able to take into account the cross section dependency. Therefore, these tests have lower power when compared with near-unit-root but stationary alternatives. If there is no evidence that panel data is cross sectionally independent, then the panel unit root methods considering cross section dependence must be applied to the data. The first of these tests applied in this study is the SURADF (Seemingly Unrelated Regression ADF) test developed by Breuer et al. (2002), and the second test is the CADF (Cross sectionally ADF) test proposed recently by Pesaran (2007). These tests are derived from ADF test, which was developed by Dickey and Fuller (1979) for univariate unit root tests. These two test procedures allow us to learn more information about how many and which members of the panel contain a unit root and which do not. Hence, the estimation efficiency is improved compared to the first generation panel unit root tests.

In this study we investigate the time series properties of per capita real GDP of 11 Middle East and North Africa countries by using panel stationary test considering the cross section dependency, namely SURADF and CADF. To the best of our knowledge, this article is the first one testing the nonstationarity of real output fluctuations in Middle East and North Africa (MENA) countries using SURADF and CADF tests. These two estimation results which are confirmed also by conventional panel unit root estimation methods indicate that the output fluctuation in MENA region are largely permanent, not transitory as proposed by conventional business cycle view. Our findings are in line with the Nelson and Plosser (1982),

Campbell and Mankiw (1987), Rapach (2002), Chang et al. (2006), Güloğlu and Ivrendi (2008) and Çınar (2010). In this context, this study provides valuable contribution to the empirical literature and policy implications.

The organization of the paper is as follows: In the section two, a brief literature is discussed. In section three policy implications of nonstationary output is analyzed. In section four the data used in this study are presented. In section five empirical results are provided and section six concludes the study.

2. Literature

There are a limited number of empirical studies using SURADF and CADF panel unit root test methods to analyze the nonstationarity of output fluctuations. Especially for MENA countries, there is not a study examining the stationarity of GDP using these tests. Therefore, we listed a group of studies in table 1 conducted for other country groups, such as OECD, G7 and Latin countries. Studies presented in the table contain the method of analysis, sample period and key findings of the study.

Fleissig and Strauss (1999) analyzed the nonstationarity of the real per capita GDP for 15 OECD countries using the conventional panel unit root tests not considering cross section dependency. They applied Maddala Wu, IPS, LL and SUR tests to the data covering the period of between 1900 and 1987. The study results clearly fail to reject the null hypothesis of a unit root only when the series in the panel are assumed to be independent. However, when they consider cross section dependency, the real per capita GDP follows a steady rate of growth and have temporary effects. Breuer et al. (2001) use data of 14 OECD countries to see whether Purchasing Power Parity (PPP) holds, and to compare the power of univariate time series ADF test and SURADF test. The results indicate that PPP holds for OECD countries and the SURADF test is at least two times more powerful than ADF test. Rapach (2002) examine the stationarity properties of the real GDP levels for 21 industrialized countries by using SUR, MADF, LL and IPS unit root tests between 1950 and 1992. They found that the null hypothesis of the nonstationary is not rejected for any of the panel when we use the LL, IPS, and SUR tests. However the MADF test suggests only one rejection (Germany) and the univariate time series test ADF suggests very few rejections of unit root null hypothesis. Chang et al. (2006) investigates the time series properties of real GDP per capita for 47 African countries by using SURADF test. They found partially evidences supporting conventional business cycle view. According to their econometric result the null hypothesis of a unit root in real GDP is rejected for 15 countries.

However, in the case of Chang et al. (2006) the number of units (*N*) is more than the time period analyzed (*T*). This decreases the estimation efficiency and power of SURADF test. These reasons lead us to be skeptical about the result of the Chang et al. (2006) study. Zhang et al. (2007) tried to determine whether unit root process is the characteristic property of the per capita real GDP of 25 Chinese provinces using SURADF test. They found that for all the provinces except Hebei, Jeilongjiang, Qinghai and Shaanxi per capita Real GDP is non-stationary. Öztürk and Kalyoncu (2007) analyzed whether the per capita real GDP in 27 OECD countries is stationary during the time period 1950 and 2004 using IPS test. They found that GDP per capita series among OECD countries are mostly nonstationary. Güloğlu and İvrendi (2008) analyzed the nonstationarity of output fluctuations for 19 Latin American countries using SURADF and CADF tests over a period of 40 years. They found that one cannot reject the presence of unit root in the real GDP per capita series of nearly most of the Latin American countries. SURADF test suggest that the data of 15 countries have unit root, while CADF test indicate that real GDP per capita of 17 countries are not stationary. These results reveal that the fluctuations in Latin American countries are permanent not transitory. Similar to Güloğlu and İvrendi (2008), Chang et al. (2008) also investigated the stationarity properties of per capita real GDP in 20 Latin American countries between 1960 and 2000. Chang et al. (2008) determined the stationarity using the panel stationary test with multiple structural breaks developed by Carrion-i-Silvestre et al. (2005). They found that the null hypothesis of stationarity in per capita real GDP cannot be rejected for any of the 20 countries. This finding contradicts with the result of Güloğlu and İvrendi (2008).

Table 1:

SUMMARY OF LITERATURE REVIEW

Study	Countries	Method	Sample period	Key findings
Fleissig and Strauss (1999)	15 OECD countries	Maddala Wu, IPS, LL, SUR	1900-1987	Results unambiguously fail to reject the null hypothesis of a unit root only when the series in the panel are assumed to be independent. However, when we consider cross section dependency, the real per capita GDP follows a steady rate of growth and have temporary effects
Breuer et al. (2001)	14 OECD countries	SURADF, ADF	1950-1995	Purchasing Power Parity holds in OECD countries and it is proved that the SURADF test lacks power when T<N, and SURADF has two or three times more power than univariate ADF test.
Rapach (2002)	21 industrialized countries	SUR, MADF, LL, IPS	1950-1992	For the LL, IPS, and SUR panel tests there are no rejections of the nonstationary null hypothesis for any of the panels. For the MADF test, there is only one rejection (Germany), and for univariate single-country ADF test there are also very few rejections of the nonstationary null hypothesis.
Chang et al. (2006)	47 African countries	SURADF	1980-2004	The null hypothesis of a unit root in real GDP is rejected for 15 and failed to reject for 32 countries.
Zhang et al. (2007)	25 Chinese provinces	SURADF	1952-1998	For all the provinces except Hebei, Jeilongjiang, Qinghai and Shaanxi, per capita real GDP are non-stationary.
Öztürk and Kalyoncu (2007)	27 OECD countries	IPS	1950-2004	GDP per capita series among OECD countries are nonstationary.
Güloğlu and İvrendi (2008)	19 Latin American countries	SURADF and CADF	1965-2004	SURADF test suggest that data of 15 countries have unit root, while CADF test indicate that real GDP per capita of 17 countries are not stationary. Fluctuations in Latin American countries are permanent not transitory.
Chang et al. (2008)	20 Latin American countries	Carrion-i-Silvestre et al. (2005) test	1960-2000	The null hypothesis of stationarity in per capita real GDP cannot be rejected for any of the 20 countries
Çınar (2010)	27 OECD countries	SURADF and CADF	1960-2008	The null hypothesis of a unit root in per capita real GDP cannot be rejected for any of the 27 countries.

Notes: IPS: Im, Pesaran and Shin, LL: Levin-Lin, SUR: Seemingly Unrelated Regression, ADF: Augmented Dickey Fuller, MADF: Modified ADF test, SURADF: Seemingly Unrelated Regression Augmented Dickey Fuller, CADF: Cross sectionally Augmented Dickey Fuller, PPP: Purchas

Similar to the study of Öztürk and Kalyoncu (2007), Çınar (2010) also examined whether per capita real GDP in 27 OECD countries is stationary or not. SURADF and CADF results of the study indicate that the null hypothesis of the unit root in per capita real GDP cannot be rejected for any of the 27 countries

3. Policy implications of GDP nonstationary

Empirical results of a large literature suggest that real output has two components: A secular growth component based on economic fundamentals and a cyclical component (unobserved stochastic part) mostly based on supply shocks. According to the theory of fluctuations in aggregate economic activity, a short-run aggregate output level can be modeled as follows (Mankiw, 2010):

$$Y_t = \overline{Y} + (P_t - P_t^e) + \nu_t \tag{1}$$

Here Y and $\overline{Y}$ stands for real and potential output (natural output) levels, and P and P^e shows current and expected price level at time t. The third term in the right side of the equation, ν(output fluctuations), is the cyclical component of the output. This equation indicates that deviations of real output from its potential level are linked to deviations of the current and expected price level and a supply shock an exogenous event (a change in oil prices or effect of bad weather on agricultural production) representing unobserved stochastic part of the aggregate demand model. The natural rate hypothesis suggests that supply shocks have only short-run effects on output and employment but have no effects on these macroeconomic variables in the long-run. Today it is known that recessions (positive supply shocks) can leave permanent scars on the output by raising the level of natural rate of unemployment (Mankiw, 2010: 399-401). Therefore, deviations of output around its long-run deterministic trend have broad implications for understanding the nature of economic phenomena (Nelson and Plosser, 1982: 160). For simplicity, let us assume that consumers expect inflation to be at its current level, so that the second term, $\beta(P_t - P_t^e)$, is zero. Then, output fluctuations can be written by a random walk with drift process:

$$\nu_t = Y_t - \overline{Y} \tag{2}$$

Here $\overline{Y}$ is the permanent secular component and ν_t is the stochastic nonstationary component of the aggregate output. These positive or negative supply

shocks given to output leads to stochastic fluctuations around its secular growth line. Namely, the stochastic fluctuations are considered as nonstationary cyclical movements around a deterministic trend.

The explanation of fluctuations in aggregate economic activity is the primary concerns of macroeconomic schools generally concentrating on cyclical variations in the growth rate. The classical theory approach takes into account the business cycles as exogenous influences. According to this theory efficient market hypothesis and self-regulating characteristic of economic activity are temporarily disrupted by external shocks, so they see fluctuations as transitory. On the other hand, Keynesian theory sees the aggregate demand as the main determinant of real output. According to Keynesian theory short-run fluctuations are not stationary, they have permanent characteristic. Therefore, the government should intervene to the economic activity through monetary and fiscal policy to smooth out short-run fluctuations. Unlike classical and Keynesian theories of business cycle, Real Business Cycle (RBC) theory takes into account the periods of economic growth as the optimal response to exogenous changes in the real economic activity (Dagum, 2010: 578-582). RBC theory argues that fluctuations in aggregate economic activity have emerged as a result of optimal response of economic actors (decision makers) to exogenous stochastic shocks on aggregate supply. This theory emphasizes that short-run fluctuations have transitory characteristics so that government should not actively intervene to the economic activity through monetary and fiscal policy to smooth out short-run fluctuations, instead government should focus on long-run structural policy changes (Kydland and Prescott, 1982). According to Monetarism and new Keynesian economics short-run fluctuations are result of the market failure.

To sum up, the question "Why do the stationarity or nonstationarity of these fluctuations have important policy implications for forecasting, modeling and evaluating the role of macroeconomic stabilization programmes" provides following answer by many authors including Plosser and Nelson (1982), Campbell and Mankiw (1987), Cribari-Neto (1996), Güloğlu and İvrendi (2008): If GDP series have a unit then policy shocks given to GDP series by policy makers will have permanent (not temporary) real effects due to its mean reverting property, i.e., an automatic return to a normal trend may not occur. This means that during a financial crises (a recession or downturn) full employment policy or a policy response against sharp contractions may have a role to perform (Libanio, 2005: 164-174; Dutt and Ros, 2003). On the contrary, policy shocks on GDP series posing no unit root will have only temporary real effects.

4. Methodology

The methodology of this study is based on two newly developed panel data tests: SURADF and CADF. The primary difference of SURADF and CADF tests from other standard panel unit root tests is that these tests can examine the stationarity property of each units in the panel individually, whereas in other tests the null hypothesis of panel unit root are combined for all of the units. These tests also consider the correlations among cross section residuals and gives efficient estimation results when $T > N$.

The first of these tests is the Seemingly Unrelated regression Augmented Dickey–Fuller (SURADF) test developed by Breuer et al. (2002). This test takes into account no across-panel restrictions imposed under either hypothesis and considers the general model of N series and T time periods, given in equation (1) below, as a system of equations (Breuer et al., 2002: 529, Güloğlu and İvrendi, 2008: 3):

$$\begin{aligned}
&\Delta y_{1,t} = \alpha_1 + \beta_1 y_{1,t-1} + \sum_{j=1}^{k_1} \delta_{1,j} \Delta y_{1,t-j} + u_{1,t} && t = 1,2,3....,T \\
&\cdot \qquad\qquad \cdot \qquad\qquad \cdot \qquad\qquad \cdot \\
&\cdot \qquad\qquad \cdot \qquad\qquad \cdot \qquad\qquad \cdot \\
&\cdot \qquad\qquad \cdot \qquad\qquad \cdot \qquad\qquad \cdot \\
&\Delta y_{\mathrm{N},t} = \alpha_N + \beta_N y_{\mathrm{N},t-1} + \sum_{j=1}^{k_N} \delta_{\mathrm{N},j} \Delta y_{\mathrm{N},t-j} + u_{\mathrm{N},t} && t = 1,2,3....,T
\end{aligned} \tag{3}$$

Where β_i is the autoregressive coefficient for each unit and is allowed to be different for each equation in the system. The SURADF procedure depends on the estimation of this system by SUR method and the significance tests of each β_i against the critical values generated through simulations (Breuer et al., 2001: 487). The motivation behind SURADF procedure is that it tests the N null and alternative hypotheses individually for each panel members within a SUR framework as shown below (Breuer et al., 2002: 531):

$$\begin{aligned}
&H_0^1 : \beta_1 = 0; \qquad H_A^1 : \beta_1 < 0 \\
&H_0^2 : \beta_2 = 0; \qquad H_A^2 : \beta_2 < 0 \\
&\cdot \qquad\qquad \cdot \\
&\cdot \qquad\qquad \cdot \\
&\cdot \qquad\qquad \cdot \\
&H_0^N : \beta_N = 0; \quad H_A^N : \beta_N < 0
\end{aligned} \tag{4}$$

Two additional advantages of this procedure are as follows: First, this procedure is more informative about how many and which members of the panel are nonstationary and which are not. Second, this procedure has a more powerful characteristic depending on moving from single equation to panel unit root tests.

The test statistics obtained from the SUR model have nonstandard distributions and thus the critical values must be obtained through Monte Carlo simulations for each individual implementation. Breuer et al. (2001) also proved that for the case $T < N$ the SURADF test has a low power.

The second panel unit root test we apply in this paper is the CADF (Cross-Sectionally Augmented Dickey Fuller) test developed by Pesaran (2007). The CADF test deals with the problem of cross-section dependence with a different approach. The motivation behind the CADF test procedure is that the members of the panel data set have an unobserved common factor. In this regard, the residuals of the system (3) consist of two parts: An unobserved part (f_t) and an individual-specific (idiosyncratic) part (ε_{it}):

$$u_{it} = \gamma_i f_t + \varepsilon_{it} \tag{5}$$

Where f_t stands for unobserved common part and ε_{it} is the idiosyncratic part that are i.i.d across the i's and t's. In the model (5) the cross section dependency part of the panel is carried out through the unobserved factor, f_t. In Pesaran (2007), this common factor, f_t is proxied by the cross section mean of y_{it} which is equal to $\overline{y}_t$ and past values of $\overline{y}_t$($\overline{y}_t$, $\overline{y}_{t-1}$, $\overline{y}_{t-2}$, $\overline{y}_{t-3}$...) for the cases N $\to \infty$ and $\gamma_i \neq 0$. Then, for an AR (p) process the relevant individual CADF test statistics is obtained by t-ratios of the β_i in the following augmented regression which is estimated by OLS (Pesaran, 2007: 283):

$$\Delta y_{it} = \alpha_i + \beta_i y_{it-1} + \sum_{j=1}^{p_i} c_{ij} \Delta y_{it-j} + h_i \overline{y}_{it-1} + \sum_{j=0}^{p_i} \eta_{ij} \Delta \overline{y}_{it-j} + \varepsilon_{it} \tag{6}$$

The null hypothesis in CADF test is expressed as follows similar to SURADF test:

$$H_0 : \beta_i = 0 \text{ for all } i = 1, 2, ..., N \tag{5}$$

is tested against the alternative hypothesis,

$$H_A : \beta_i < 0, \quad i = 1, 2, ..., N \tag{6}$$

Unlike SURADF test the CADF test is also valid for the case $T<N$, and gives efficient result for both the cases $T<N$ and $T>N$. The critical values of CADF statistics can be obtained from the study of Pesaran (2007). As a result although there are some other second generation tests considering cross-sectional dependencies like Bai and Ng (2001), Moon and Perron (2004), Philips and Sul (2003) and Choi (2002), the advantage of SURADF and CADF test is that they report estimation results for each panel members individually and give more informative about which members are stationary and which are not.

5. Data

In this study the annual real GDP per capita (constant 2005 US*$*) is used as the measure of the real output. The data covers the period 1970 -2012 for the following 11 selected Middle East and North Africa (MENA) countries: Algeria, Egypt, Iran, Israel, Kuwait, Malta, Morocco, Oman, Saudi Arabia, Syria and Tunisia. All the data are obtained from the World Development Indicators database of the World DataBank. Table 2 and figure 1 show the descriptive statistics of the data. During the period 1970-2012, the highest and lowest GDP per capita belongs to Saudi Arabia and Egypt, respectively: 22403 (US$) and 421(US$). But the countries having the highest and lowest GDP per capita are Israel 15457(US$) and Egypt 918(US$), and the country having maximum fluctuation in its GDP per capita is Malta. Jarque-Bera statistics indicate that we reject the null hypothesis of normal distribution at the 5 % but not at the 10% significance level only for Saudi Arabia. Skewness and Kurtosis statistics support JB test results.

Table 2:

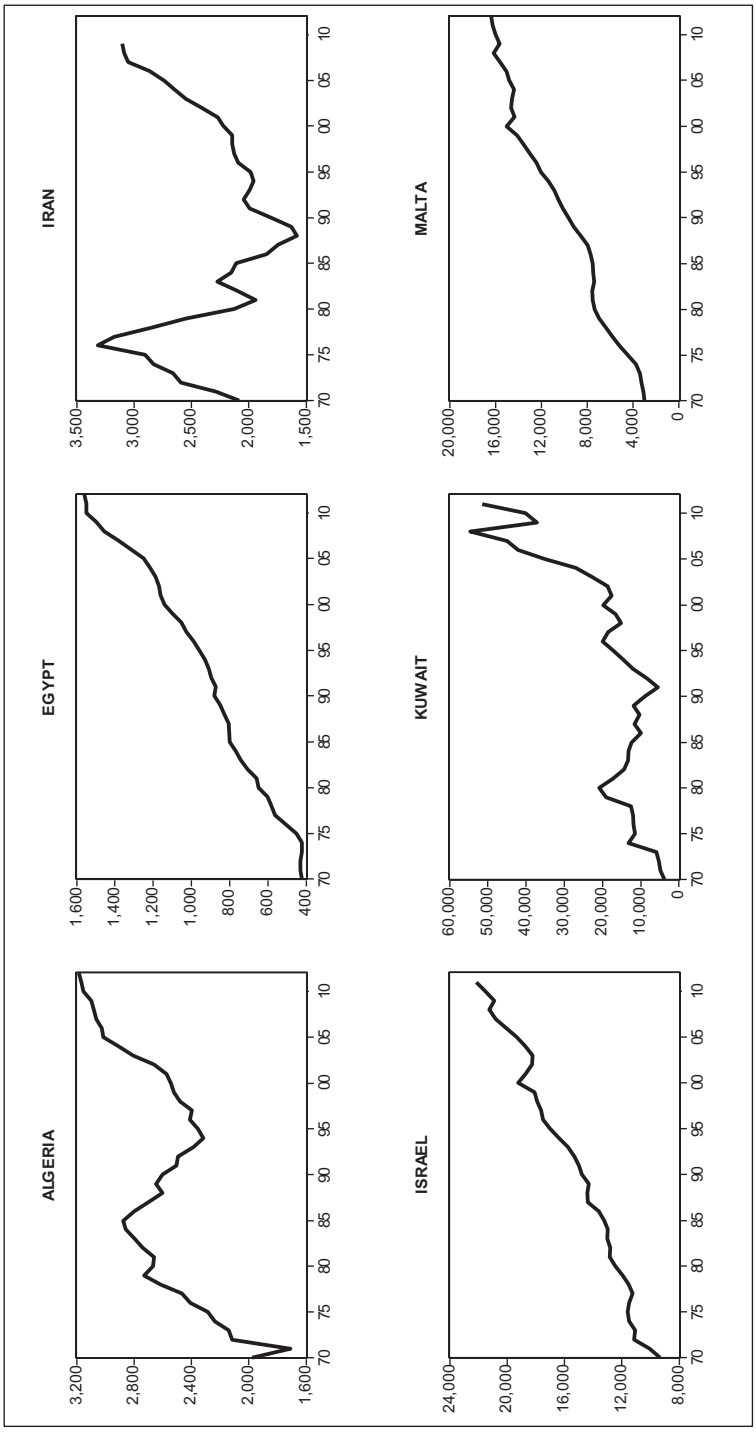
SUMMARY STATISTICS FOR ANNUAL REAL GDP PER CAPITA (US$)

Statistics	Algeria	Egypt	Iran	Israel	Kuwait	Malta	Morocco	Oman	Saudia A.	Syria	Tunisia
Mean	2622	918	2348	15457	5239	10223	1539	9577	14686	1269	2306
Maximum	3186	1560	3316	22129	9326	16350	2463	15145	22403	1700	3807
Minimum	1706	421	1579	9330	2740	2999	954	4826	10561	677	1102
Std. Dev.	333	344	456	3598	1691	4339	411	2950	3560	258	777
Skewness	-0.329	0.279	0.434	0.197	0.828	-0.122	0.733	0.160	1.244	-0.384	0.602
Kurtosis	3.046	2.128	2.184	1.824	3.556	1.693	2.698	2.007	2.903	2.720	2.231
JB-p values	0.677	0.383	0.306	0.260	0.095	0.205	0.134	0.386	0.004	0.566	0.161
Observations	43	43	40	42	37	43	43	42	42	41	43

Note: JB: Jarque- Bera statistics

Figure 1:

GRAPHICAL PRESENTATIONS OF THE ANALYZED DATA



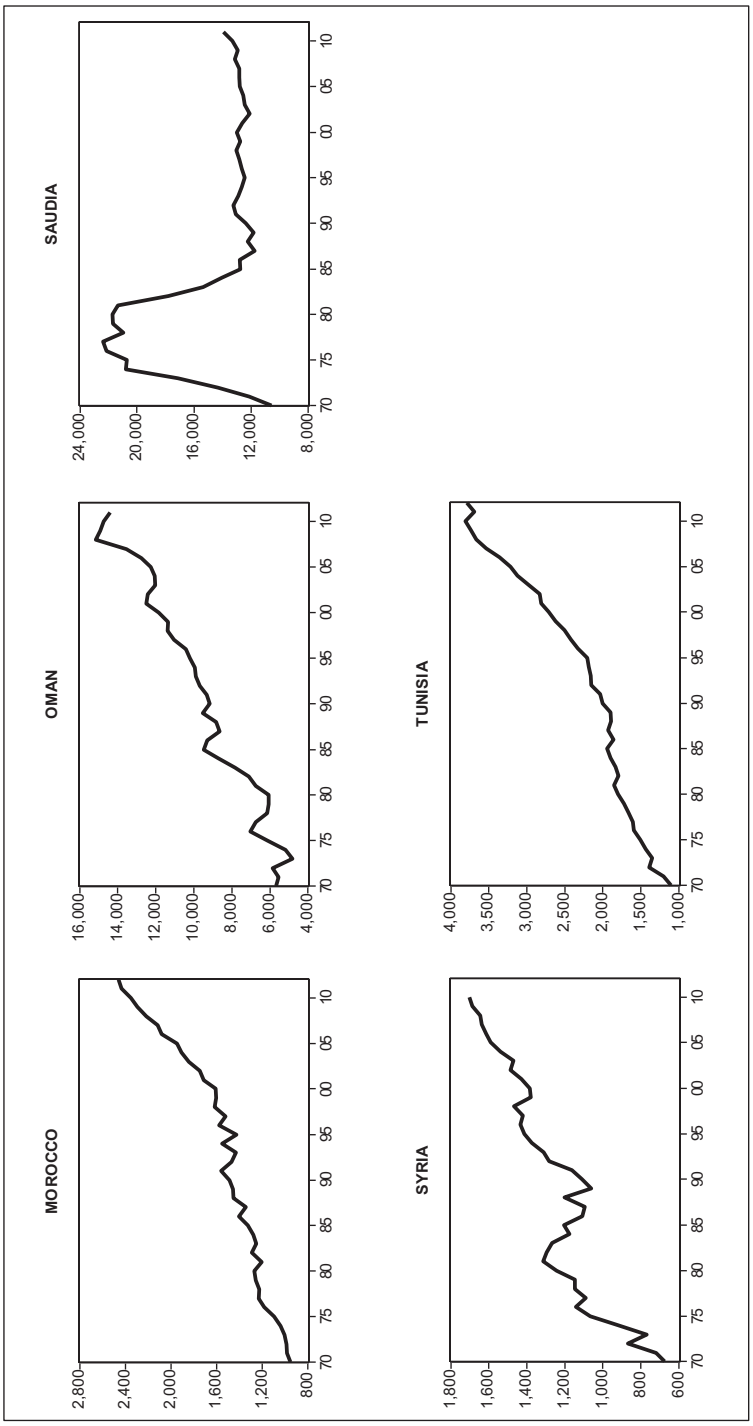

SAUDIA
OMAN
MOROCCO
TUNISIA
SYRIA
70
75
80
85
90
95
00
05
10

Figure 1 shows that GDP series of each particular country have an increasing trend in generally, but the GDP series of Iran, Algeria, Kuwait and Saudi Arabia seem to have a structural break for the date 1978, 1995, 1980 and 1992 respectively. We should formally test the presence of a structural break in these series using unit root test allowing for a structural break in the next section.

6. Empirical results

In this section univariate unit root tests (with and without structural break) and panel unit root test methods (first and second generation) are applied to data of MENA countries. If units forming panel are independent to each other (no cross sectional dependence), we will apply first generation panel unit root tests, namely Levin, Lin and Chu (2002), Breitung (2000), Im, Pesaran and Shin (2003), Fisher- ADF, Fisher-PP, Maddala and Wu (1999) and Hadri (2000). The common assumption of these tests is that there is cross section independence among panel members. The univariate unit root tests we employ to each panel member individually are ADF and Zivot-Andrews (ZA) structural break unit root test. Estimation results of these tests are presented in panel A, B, C and D in Table 3. In the panel A and B the univariate time series results and in the Panel C and D the panel unit root tests results are presented. Tests in Panel C (LLC, Breitung and Hadri) indicate the results assuming common unit root process, whereas tests in panel D (IPS, Fischer-ADF and PP, Maddala Wu) allow for individual unit root processes. It is clearly seen from the table 3 that the real GDP per capita of 10 MENA countries are nonstationary, namely data of 10 countries include a unit root. Both panel unit root tests and individual unit root tests (ADF and ZA) suggest that the only country having a stationary GDP per capita in the level is Algeria for ADF test and Iran for ZA test. The presence of a structural break in the GDP series of Iran for the year 1978 is also clearly seen from Figure 1.

Table 3:

UNIVARIATE TIME SERIES AND FIRST GENERATION PANEL UNIT ROOT TESTS RESULTS

	ADF	lag	Prob		ADF	lag	Prob
Panel A: Univariate time series unit root test							
Tunisia	-2.82	4	0.33	Israel	-2.79	1	0.20
Syria	-2.68	0	0.24	Iran	-0.93	5	0.90
Saudi A.	-2.82	1	0.19	Egypt	-2.49	2	0.32
Oman	-2.49	2	0.32	Algeria	-4.75	7	0.00**
Morocco	-4.60	1	0.16	Kuwait	-0.71	0	0.96
Malta	-1.16	0	0.90				
Panel B: Zivot-Andrews test allowing for a structural break							
	ZA[b]	Date	Prob		ZA	Date	Prob
Tunisia	-2.79	2003	0.02**	Israel	-4.36	1993	0.10***
Syria	-3.96	1984	0.00*	Iran	-3.60	1978	0.95
Saudi A.	-9.45	1982	0.00**	Egypt	-4.45	2006	0.00*
Oman	-5.08	1990	0.02**	Algeria	-5.33	1987	0.02**
Morocco	-2.33	2006	0.10***	Kuwait	-5.35	1980	0.00*
Malta	-3.35	1994	0.02**				
Panel C: LLC, Breitung and Hadri tests				*Panel D: IPS, Fischer-ADF and PP, Maddala Wu*			
	Statistics	Prob			Statistics	Prob	
LLC	0.05	0.52		IPS	0.22	0.59	
Breitung	1.18	0.88		Fischer-ADF	25.34[a]	0.18	
Hadri	2.28	0.01		Fischer-PP	13.57[a]	0.85	
				Maddala Wu	6.97	----	

Levin, Lin, and Chu (LLC), Breitung, and Hadri tests all employ the assumption that there is a common unit root process so that ρ_i is identical ($\rho_i = \rho$) for all individuals across the cross sections. Here ρ_i shows correlation coefficient between two individuals and equals to $\sum_{j=1}^{n}(X_j - \overline{X})(Y_j - \overline{Y}) \Big/ (n-1)s_Y s_X$ where S_y and S_x are standard deviation of the sample. However, the Im, Pesaran, and Shin, and the Fisher-ADF and PP tests all allow for individual unit root processes so that may vary across cross sections (Eviews 7 User's Guide II, 2010: 399). The null hypothesis of Hadri test is assuming no unit root, whereas the null hypothesis of other tests are assuming unit root in series. Individual effect and individual trend are included in test equation for all tests.

[a]: Fischer Chi-square

[b]: The null hypothesis of ZA test is assuming a unit root with structural break in both the intercept and trend.

***, ** and *: Shows the statistical significance at 10%, 5% and 1% level.

The cross section independence is quite a powerful assumption which weakens the result of first generation unit root tests. Therefore, if there is no evidence that panel data is cross sectionally independent, namely all units forming panel are dependent to each other, then the second generation panel unit root tests need to be employed. For this purpose, firstly cross sectional independence needs to be carried out to apply second generation unit root tests. In this study, cross section independence is tested by CDLM1, CDLM2 and CDLM tests developed by Breusch-Pagan (1980) and Pesaran (2004), respectively. When $T > N$ the Lagrange multiplier test (CDLM1) proposed by Breusch and Pagan (1980), and when T and N are large enough CDLM2 test proposed by Pesaran (2004) is the most appropriate test method to examine the cross dependency. On the other hand the only CDLM test is not valid when T is large enough and N is small, which is the case in our data, but, even so, we will report test result of this test as well. In our case, T= 43 and N=11 satisfies the cases $T>N$ and the case of being large enough. These test statistics are calculated as follows as proposed by authors:

$$CDL_{M1} = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\rho^2_{ij} \tag{7}$$

$$CDL_{M2} = \sqrt{\frac{2}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}T\rho^2_{ij} - 1\right) \tag{8}$$

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\rho^2_{ij}\right) \tag{9}$$

Where $\hat{p}_{ij}$ stands for the sample estimate of pairwise correlations of the residuals. Furthermore, the null hypothesis of these tests;

$$H_0 = \rho_{ij} = cor(u_{it}, u_{jt}) = 0 \text{ for } i \neq j, \text{(cross-sectional independence)} \tag{10}$$

is tested against

$$H_A = \rho_{ij} \neq 0 \text{ at least for some } i \neq j, \text{(cross-sectional independence)} \tag{11}$$

Table 4 shows CD test results with corresponding probabilities. According to table, the correlations among the cross sectional residuals are strongly supported by the tests CDLM1, CDLM2 and CDLM. These test results reveal that cross section dependence has to be taken into account when testing the stationarity of panel series.

Table 4:

CROSS SECTION DEPENDENCE TESTS RESULTS

CD tests	**t-statistics**	**Probability**
CD_{LM1} (Breusch-Pagan 1980)	238.249	0.000
CD_{LM2}(Pesaran, 2004)	25.879	0.000
CD_{LM} (Pesaran, 2004)	14.299	0.000

Note: The null hypotheses of CD tests are of presence of no cross sectional dependence in panel. Maximum lag length for CD_{LM1} and CD_{LM2} test is 5, and models are estimated with constant and trend.

Due to the results of CD tests, we use second generation panel unit root tests allowing for cross section dependence to determine the stationarity property of per capita real GDP as mentioned in the methodology. For this purpose, SURADF and CADF panel unit root tests are applied to GDP per capita data of 11 selected MENA countries for the time period between 1970 and 2012. The SURADF and CADF tests results are presented in table 3. We use Monte Carlo simulations with 1000 replications to derive critical values for SURADF test. The SURADF test results shown in the left panel of Table 5 suggest a unit root in per capita real output data of the 10 MENA countries. The null hypothesis of unit root is rejected only for the case of Algeria. In this regard, both the univariate unit root test ADF and SURADF test show the same results.

The CADF test result illustrated in right panel of Table 5 also supports the results obtained from SURADF. The CADF results indicate a unit root in real GDP per capita for 9 MENA countries. The null hypothesis of nonstationarity is rejected only for Malta and Israel at a 10 percent significance level. As a result, the CADF and SURADF panel unit root tests reveal that real GDP per capita of most of the MENA countries is nonstationary. These tests results provide powerful evidence in favor of presence of a unit root in real output. The economic inference of this result is as follows: Although conventional view of business cycle suggests that fluctuations in output represent temporary deviations from trend, namely in the long-run output fluctuates around a deterministic trend line (Campbell and Mankiw, 1987: 857-859), our estimation results provide evidence that shocks to real GDP per capita are largely permanent instead being transitory around a deterministic line. Therefore, panel unit root test results show that the fluctuations in real output will no longer be considered as transitory but, rather as permanent for most of the MENA countries.

Many earlier or recent studies like Nelson and Plosser (1982), Campbell and Mankiw (1987), Rapach (2002), Chang et al. (2006), Su et al. (2007), Güloğlu and

Ivrendi (2008) and Çınar (2010) which are using ARIMA, SURADF, CADF and different econometric methods also found GDP or per capita real GDP as nonstationary in their studies consistent with our findings. However, our results are inconsistent with findings of Fleissig and Strauss (1999) who find evidence on favor of stationarity of real GDP per capita for OECD countries and Chang et al. (2008) who empirically shows that the real GDP per capita of most Latin American countries are stationary.

Table 5:

SURADF AND CADF TESTS RESULT

Countries	SURADF	p	1%	5%	10%	CADF	p
Tunisia	-3.370	5	-4.988	-11.643	-15.803	-3.260	5
Syria	2.570	6	-3.95	-19.145	-93.045	-2.920	6
Saudi A.	0.967	2	-4.556	-37.213	-70.953	-2.271	2
Oman	-1.657	2	-4.762	-15.422	-36.130	-3.087	2
Morocco	-1.502	2	-4.455	-16.921	-55.350	-2.210	2
Malta	1.471	2	-5.122	-31.447	-16.245	-3.847*	2
Israel	-1.840	2	-3.591	-18.428	-11.775	-3.899*	2
Iran	-2.386	2	-4.513	-31.405	-71.160	-3.173	2
Egypt	0.620	2	-4.743	-10.053	-26.703	-3.226	2
Algeria	2.690*	2	-3.063	-26.120	-2.445	-2.350	2
Kuwait	1.875	5	-4.945	-112.802	-18.033	-2.031	5

*Notes:*a/ ***, ** and * shows statistical significance at 1, 5 and 10% levels, respectively.

b/The null hypothesis of the SURADF test is that series has a unit root.

c/The null hypothesis of the CADF test is that series has a unit root

d/the critical values for SURADF test are calculated from Monte Carlo simulations with 1000 repeations.

e/The critical values (CV) for the CADF test are obtained for the model having trend and intercept in from f/Pesaran (2007) table Ic. These CV's are -4.49, -3.78 and -3.44 for 1, 5 and 10% levels, respectively.

g/The lag lengths are automatically selected according to Schwarz Information Criterion (SIC)

7. Conclusion

It is now a well-known fact that if a macroeconomic series has no unit root, we characterize it as stationary, it fluctuates over the business cycle in short-run but it returns to its constant long-run mean in long-run. Being stationary also refers that the series has a time- invariant variance so that cyclical shock is dampened over time. In this case shocks indicate a temporary characteristic. However, if a series has a unit root, it is nonstationary so that the mean and variance are changing over time. In this case, time-variant mean and variance of the series show no tendency to return to their long-run deterministic path, instead they go to infinity. To be more precise, the nonstationary series implies that the shocks given to macroeconomic variables show a permanent characteristic.

If a trend stationary processes characterize the output fluctuations, i.e. fluctuations in output are considered as stationary, then monetary and fiscal shocks will have temporary effects on economy and the path of output will be bounded. But a nonstationary adverse supply shock, such as the rise in world oil prices or a nonstationary positive supply shock, such as technology shocks, have permanent effects on output and the path of output will be unbounded (Güloğlu and İvrendi, 2008: 1). In this case the monetary and fiscal shocks will have significant effects on output. These shocks change the economic environment immediately and have an immediate impact on the economy's short-run equilibrium. The path of output, inflation and many other macroeconomic variables are also affected permanently (Mankiw, 2010: 409).

In this study we examine the stationarity property of output fluctuations of 11 MENA countries using both newly developed panel unit root tests, taking into account the cross section dependency, and first generation standard panel unit root test with well-known univariate unit root tests. The data to be tested in this paper are annual real GDP per capita covering the time period between 1970 and 2012. Since the univariate time series tests and first generation standard panel unit root tests have less power than the tests taking into account the cross section dependence, and since cross section dependency tests suggest that the time series forming panel are dependent to each other, we prefer to apply SURADF and CADF test methods, which are recently developed and generally known as second generation panel unit root test methods.

Both SURADF and CADF tests results suggest that the real output of most of the MENA countries are nonstationary. Estimation result of these two tests strongly rejects the null hypothesis of unit root in GDP per capita for most of MENA countries. In another saying, we find evidence contrary to the traditional view of business cycle support the idea that the fluctuations in real output represent

a temporary deviation from its natural rate of output. Our results suggest that the shocks to the GDP are largely permanent rather than transitory.The univariate unit root process ADF and ZA (for structural break) and standard panel unit root test methods LLC, IPS, Hadri, Maddala Wu also confirm the nonstationarity of real GDP per capita data.

The result of this study has important policy proposes for MENA regions in where economic and political instabilities create external shocks on aggregate demand. In addition, the effectiveness of stabilization policies targeted real output by government and other policy makers should be reviewed to achieve long-lasting results.

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JESU LI FLUKTUACIJE PROIZVODNJE TRANZITORNE U MENA REGIJI?

Sažetak

U istraživanju je primjenom dviju suvremenih metoda propitivana stacionarnost realnog BDP-a po stanovniku za skupinu 11 zemalja Bliskog istoka i Sjeverne Afrike (eng. Middle East and North Africa – MENA) u razdoblju 1970.-2012. Primjena metoda SURADF (eng. Seemingly Unrelated Regression Augmented Dickey Fuller) i CADF (eng. Cross sectionally Augmented Dickey Fuller) u testovima jediničnih korijena na panel podacima omogućava identifikaciju ovisnosti u uzorku zemalja obuhvaćenih presjekom, i utvrđivanje jesu li fluktuacije u proizvodnji permanentne ili tranzitorne. Suprotno tradicionalnim pogledima o poslovnom ciklusu, autor utvrđuje postojanje ekonometrijskog uporišta za tvrdnju da su fluktuacije proizvodnje u MENA regiji uglavnom permanentne. Ovakvi rezultati upućuju na potrebu preispitivanja dugoročne učinkovitosti mjera politika stabilizacije koje kao ciljanu varijablu imaju realnu proizvodnju.

Ključne riječi: testovi jediničnih korijena na panel podacima, MENA regija, SURADF, CADF, fluktuacije u proizvodnji