9. THE VALIDITY OF PURCHASING POWER PARITY HYPOTHESIS IN MIDDLE EAST AND NORTHERN AFRICA COUNTRIES

Hüseyin KALYONCU[1]
Ferit KULA[2]
Alper ASLAN[3]

Abstract

This paper re-examines the Purchasing Power Parity (PPP) hypothesis in which the endogenously determined break points are incorporated in thirteen major Middle East and Northern Africa (MENA) countries by using official and black market exchange rates data over 1970-1998. We utilize Lagrange Multiplier (LM) unit root test that endogenously determines structural breaks in level and trend. We find evidence of PPP for all countries using official and/or black market real exchange rates at the 10% level or better.

Keywords: Purchasing Power Parity (PPP), Real exchange rate, Black market Exchange rates, Unit-root test, Structural break

JEL Classification: F31, C22, C23

I. Introduction

Purchasing power parity (PPP) has been one of the most enduring concepts in international economics. The theory, which is a generalization of the law of one price, supposes that all goods are identical and transportation costs and trade barriers are very low in both countries. The absolute version of the theory asserts that under these conditions, the same basket of goods and services should cost the same when expressed in terms of the same currency.

[1] (Corresponding Author), Meliksah University, Faculty of Economics and Administrative Sciences, Department of International Trade and Business, Kayseri, Turkey, Email: hkalyoncu@meliksah.edu.tr.
[2] Erciyes University, Faculty of Economics and Administrative Sciences, Department of Economics, Kayseri, Turkey, Email: kulaf@erciyes.edu.tr.
[3] Meliksah University, Faculty of Economics and Administrative Sciences, Department of International Trade and Business, Kayseri, Turkey, Email: alperaslan@meliksah.edu.tr.

On the other hand relative PPP is said to hold when the rate of depreciation of one currency relative to another matches the difference in aggregate price inflation between the two countries concerned. If the nominal exchange rate is defined simply as the price of one currency in terms of another, then the real exchange rate is the nominal exchange rate adjusted for relative national price level differences (Sarno and Taylor, 2002).

The validity of the PPP has been extensively tested, especially for developed countries In general, PPP is valid long run equilibrium condition at least in industrialized economies (see the survey of Froot and Rogoff, 1995; Sarno and Taylor, 2002; Sarno 2003). On the other hand, empirical evidence on the validity of long run PPP for developing countries is rather mixed (see, for example, Telatar and Kazdaglı, 1998; Bahmani-Oskooee and Mirzai, 2000; Basher and Mohsin, 2004; Kalyoncu, 2009).

There are few studies (Bahmani-Oskooee, 1998; Narayan and Prasad, 2005) on the exchange rates of MENA countries as a group. Their main finding from univariate tests is that there is evidence for PPP in only limited number of countries. A common feature of the studies mentioned above is that they have all used official exchange rates data in testing the PPP. But, a group of studies (e.g. Age´nor and Taylor, 1993; Luintel, 2000) that have used the black market rates have generally supported PPP more than those that have used official rates in the developing country context. In MENA countries covered in the present study, black market exchange rates have a long tradition. To this end, the objective of this paper is to extend the previous empirical literature on PPP in MENA by examining the mean reversion of official and black market real exchange rates.

The outline of this study is as follows. After defining the analytical framework of PPP hypothesis in Section II, the methodology and sources of the data employed are described in section III. In section IV and V empirical results and conclusion are presented, respectively.

II. Analytical Framework

In order to test purchasing power parity we begin with the calculation of the real exchange rate. The real exchange rate is calculated as follows:

$$RER = NER\frac{P^*}{P} \tag{1}$$

where RER is the real exchange rate, NER is the nominal exchange rate and P* and P are the foreign and domestic prices, respectively. In logarithmic form, the real exchange rate can be represented by

$$\log(RER) = \log(NER) + \log(P^*) - \log(P) \tag{2}$$

Following equation shows the model of mean reverting real exchange rate

$$\log(RER)_t = \alpha + \beta\log(RER)_{t-1} + \varepsilon_t \tag{3}$$

where α and ε are constant and error term respectively. PPP suggest that real exchange rate series should be stationary. If real exchange rate is stationary this exhibit that any percentage changes in the price level between two countries would be offset by an equal depreciation/appreciation of the nominal exchange rate. If there is a unit-root in the real exchange rate this implies that shocks to the real exchange rate are permanent and PPP does not exist between two countries

III. Methodology and data

This paper applies univariate LM unit root tests with structural breaks proposed by Lee and Strazicich (2003). We utilize the most general model that allows for up to two breaks in the level and trend of the series. According to the LM (score) principle, a unit root test statistic can be obtained from the following regression:

$$\Delta Y_t = \delta' \Delta Z_t + \phi \tilde{S}_{t-1} + \sum_{1}^{k} \gamma_i \Delta \tilde{S}_{t-i} + \varepsilon_t \tag{4}$$

Where $\tilde{S}_t$ de-trended series that $\tilde{S}_t = Yt - \tilde{\psi}_x - Z_t \tilde{\delta}$, for $t=2,....,T$. $\tilde{\delta}$ is a vector of coefficients estimated from the regression of ΔYt on ΔZt and $\tilde{\psi}_x = Y_1 - Z_1 \tilde{\delta}$, where Y_1 and Z_1 first observations Y_t and Z_t, respectively. Z_t is a vector of exogenous variables defined by the data generation process of the series. Model includes two breaks in level and trend is described by $Z_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]'$, where $D_{jt} = 1$ for $t \geq T_{bj} + 1$, $j = 1,2$ and zero otherwise.

The unit root null hypothesis is described by $\phi = 0$ (implying a unit root with two breaks), and the LM test statistics are given by:

$$\tilde{\tau} = \text{t statistics for the null hypothesis } \phi = 0. \tag{5}$$

The minimum LM unit root t-statistic determines the endogenous location of two breaks $(\lambda_j = T_{bj}/T, j = 1,2)$. The LM unit root test can endogenously determine the two breaks by utilizing a grid search as follows:

$$LMt = \inf_{\lambda} \tilde{\tau}(\lambda) \tag{6}$$

In order to test the validity of PPP we construct two dataset. In first dataset we use black market exchange rates (BMREX) and second dataset we use official exchange rates (OREX).

The black market and official exchange rates data are taken from the study of Reinhart and Rogoff (2004). We converted these series into real exchange rates by using consumer price indices. Real exchange rates are constructed defining relative prices as the ratio of US consumer price index (CPI) to each country's consumer price index CPI. CPI data are taken from the International Monetary Fund's International Financial Statistics (IMF-IFS) database. All series are expressed in logarithms. Due to

the lack of consistent data on the CPI index for some countries before 1970 and unavailability of data beyond 1998 for black market, the data spans from 1970-1998. The thirteen MENA countries considered in this study are Algeria, Egypt, Iran, Iraq, Israel, Jordan, Lebanon, Libya, Morocco, Saudi Arabia, Syria, Tunisia and Turkey.

IV. Empirical Strategy and Results

Following Lee at al. (2004), in the beginning, we determine the number of lagged augmentation terms and we start from a maximum of k=8 lagged terms. As such, the procedure looks for the significance of the last augmented term. We then use the 10% asymptotic normal value of 1.645 on the t-statistic of the last first differenced lagged term. After determining the optimal k at each combination of two break points, we can determine the breaks where the endogenous two break LM t-test statistic is at a minimum. We examine each possible combination of two break points over the time interval [0.1T, 0.9T] while eliminating the endpoints. Here, T is the sample of size.

We begin with the LM unit root t-statistic with two breaks and examine the significance of the dummy coefficients on the basis of the conventional t-statistics. If less than two breaks are significant at 10% we apply the minimum LM unit root t-statistic with one break proposed by Lee and Strazicich (2004).

Table 1

Two break minimum LM unit root test

	OREX		BMREX	
Country	**LM Statistics**	**Breaks**	**LM Statistics**	**Breaks**
Algeria	-7.324 (8)***	1989 1993	-5.997 (8)**	1982 1992
Egypt	-19.804 (8)***	1984 1989	-5.732 (7)***	1983 1987
Iran	-29.443 (4)***	1986 1991	-5.115 (6)	1981 1990
Iraq	-11.804 (7)***	1989 1992	-22.872 (8)***	1983 1991
Israel	-5.598 (3)**	1981 1985	-7.475 (8)***	1982 1994
Jordon	-13.504 (8)***	1987 1996	-11.548 (8)***	1987 1994
Lebanon	-8.725 (7)***	1982 1985	-9.014 (2)***	1982 1985
Libya	-13.140 (8)***	1988 1991 (N)	-5.663 (8)*	1984 1992
Morocco	-6.487 (1)***	1980 1985	-6.601 (4)***	1980 1984
Saudi Arabia	-7.778 (4)***	1980 1990	-7.928 (4)***	1980 1990

	OREX		BMREX	
Country	**LM Statistics**	**Breaks**	**LM Statistics**	**Breaks**
Syria	-11.050 (8)***	1983 (N) 1986	-7.697 (7)***	1983 1996 (N)
Tunisia	-4.371 (5)	1983 1986	-6.707 (7)***	1980 1991
Turkey	-9.321 (7)***	1982 1986	-4.891 (6)	1980 (N) 1993

Notes: *The critical values depend on the location of the breaks and are obtained from Lee and Strazicich (2003). *, **, and *** denote significant at the 10%, 5%, and 1% levels, respectively. (N) denotes that the identified break point was not significant at the 10% level. Numbers in the parentheses are the optimal number of lagged first-differenced terms included in the unit root test to correct for serial correlation.*

Results of employing the two break LM unit root test for the sample period 1970–1998 are shown in Table 1. Twelve of the thirteen OREX series reject the unit root null at the 5% level or better. The null hypothesis is not rejected for Tunisia. The examination reveals that two structural breaks in level are significant (t-values significant at 10%) for eleven OREX series, while only one structural break is significant in the two countries (Libya and Syria). The results of the unit root tests as shown in Table 1 appear to support that the BMREX series are stationary for the sample of eleven countries. However, the null hypothesis is not rejected for Iran and Turkey. Table 1 also shows that two structural breaks in level are significant eleven BMREX series. It is found that one structural break exist in only Syria and Turkey out of 13 countries for BMREX series.

One break unit root test appears more appropriate for OREX in Libya and Syria and for BMREX in Syria and Turkey. We perform additional tests for these four series using the one break minimum LM unit root test. The results are shown in Table 2.

Table 2

One break minimum LM unit root test

	OREX		BMREX	
Country	**LM Statistics**	**Break**	**LM Statistics**	**Break**
Libya	-5.773 (8)***	1990	-	-
Syria	-4.023 (8)	1993	-7.269 (7)***	1983
Turkey	-	-	-4.662 (6)*	1993

Notes: *The critical values depend on the location of the breaks and are obtained from Lee and Strazicich (2004).*, and *** denote significant at the 10% and 1% levels, respectively. Numbers in the parentheses are the optimal number of lagged first differenced terms included in the unit root test to correct for serial correlation.*

One break point is significant in all series at the 10% level. The one break results for OREX in Libya and for BMREX in Syria are essentially unchanged as compared to the two break test. But now, the unit root null is rejected for BMREX in Turkey when the null hypothesis is not rejected for OREX in Syria.

Overall, we find evidence of PPP for all countries using OREX and/or BMREX at the 10% level or better. More precisely, the unit root null is rejected for OREX in Algeria, Egypt, Iran, Iraq, Israel, Jordon, Lebanon, Libya, Morocco Saudi Arabia and Turkey, while the unit root null is rejected for BMREX in Algeria, Egypt, Iraq, Israel, Jordon, Lebanon, Libya, Morocco Saudi Arabia, Syria, Tunisia and Turkey. Rejection of the null hypothesis would imply that these series exhibit mean reverting tendencies. In other words, PPP holds.

V. Conclusion

Using official and black market real exchange rates data from thirteen MENA countries are examined over the period 1970–1998 to test for evidence of PPP. We utilize a LM unit root test that endogenously determines breaks in level and trend. We find that all exchange rates series reject the unit root null at the 10% significance level or better, except for OREX in Tunisia and Syria and for BMREX in Iran. The PPP holds for both official and black market real exchange rates in ten countries out of thirteen cases.

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