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EXAMINING THE VALIDITY OF PPP: THE BLACK MARKET EXCHANGE RATE VERSUS OFFICIAL RATE[1]

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Abstract

The long-run purchasing power parity (PPP) hypothesis is re-examined for Turkey by using the black market and official exchange rate through standard (ADF, PP) newer and more powerful tests (KPSS, DF-GLS) for the period 1969M1- 1998 M12. Over all result implies all unit root test support PPP in Turkey. This could be explained by a high similarity with the exchange rate series.

KEYWORDS**:** PPP, Black Market Exchange Rates.

JEL classification**:** F31

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Introduction

The purchasing power parity (PPP) is commonly interpreted as the co-movement of the exchange rate and the relative price of two countries. The origins of PPP concepts date back to the fifteenth and sixteenth centuries (Officer, 1982). However, the term PPP itself was coined at the beginning of the last century (Cassel, 1918).

Many studies, using different time periods and different currencies with various econometric techniques, were performed to investigate for long run PPP. However, the results were mixed. Although numerous studies supported the existence of PPP, some of them found very little or no evidence for PPP. One explanation for this unexpected result is the use of short data with standard unit root tests (Lothian & Taylor, 1997; Taylor & Taylor, 2004, Taylor, 2006 and 2009).

It has been debated that the ability to test for consistency of the PPP hypothesis in emerging economies is prevented by the frequent variation in the exchange rate arrangement, resulting in long periods of fixed exchange rates. Furthermore, the same specification of the PPP hypothesis is not applicable to countries adopting different exchange rate regimes. To cope with the problem, it has been suggested that the black market exchange rate better represents market forces, compared to the administrated official exchange rate (OREX), when testing for PPP. A black market exchange rate (BMREX) occurs when governments try to restrict capital flow by imposing various types of restrictions on the purchase of foreign currencies. These restrictions contain licensing, time delay and various taxes (Hassanain, 2005).

These limitations on the purchase of foreign currencies create excess demand for foreign currencies which cannot be met by the official market and thus generates an unofficial (black) market in the emerging markets, for instance Turkey, the country covered in the present study.

In many countries, the volume of transactions in black markets happens to be larger than that in the official market (Cerrato & Sarantis, 2007). Despite the fact that BMREX play an important role in emerging market economies and the studies like Nagayasu (1998), Baghestani (1997) and Bahmani-Oskooee (1993) have suggested that tests for PPP may perform better when the black market rate is used, there are very few papers using this major source of information to investigate the long-run PPP hypothesis.

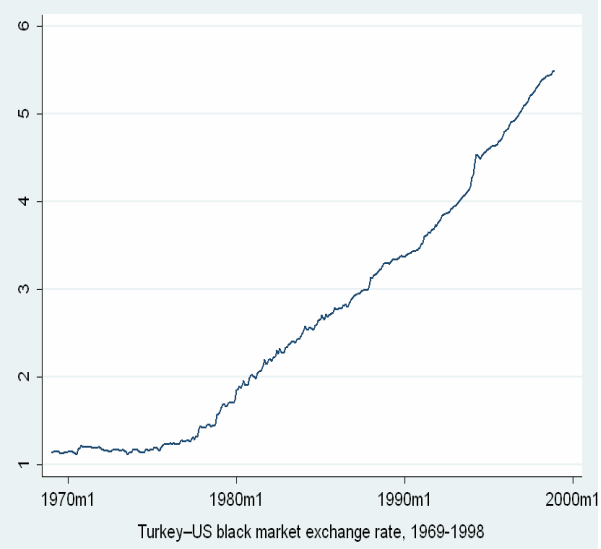
Such as the studies Age´nor & Taylor (1993), Phylaktis & Kassimatis (1994), Baghestani (1997), Phylaktis & Girardin (2001) and Cerrato & Sarantis (2007) used to analyze the validity of PPP hypothesis by using black market rate.

The validity of PPP hypothesis has been considered based on Turkish data by numerous researchers. Telatar and Kazdaglı (1998) examined the hypothesis of long-run PPP using co integration techniques for Turkey. The results do not support any long-run bilateral exchange price-rate relationship between Turkey and each of the following countries regarded as the major trading partners of Turkey: France, Germany, the UK, and the USA. Extending the study of Telatar and Kazdagli, Sarno (2000) has re-examined the long-run PPP hypothesis using data for Turkey and its major trading partners. While conventional unit root tests do not facilitate the detection of mean reversion in real exchange rates - and, thus, imply rejection of long-run PPP over the sample using recently developed nonlinear modeling techniques - strong support is provided for the validity of long-run PPP as well as for theoretical models which predict nonlinear adjustment in real exchange rates.

Yazgan (2003) has also re-examined the long-run PPP hypothesis for Turkey and strong evidence on long-run PPP is provided by using standard multivariate co integration techniques. In another study concerning Turkey, Erlat (2003) investigated the persistence in real exchange rates by using unit root tests and autoregressive fractionally integrated moving average (ARFIMA) models. Two real exchange rates are considered in the paper, one in terms of the German DM and the other, in terms of the US$, and the strong evidence of “stationarity” are found in almost all series. These findings, then, support the validity of the absolute version of the "quasi" purchasing power parity hypothesis for Turkey. Kalyoncu (2009) investigated the validity of purchasing power parity (PPP) between Turkey and trading partners, such as USA, Germany, Japan, France, Netherlands and UK. By using different unit root test and different base countries to determine if the validity of PPP is influenced by the type of test and/or the base country. According to estimation results, PPP testing is sensitive to the choice of the base country and can be influenced by the type of test.

Although the validity of PPP hypothesis has been considered on Turkish data by these studies as mentioned earlier, no study has focused on BMREX. The objective of this study is to test the validity of PPP for both BMREX and OREX in Turkey over the period 1969:1-1998:12.

Fig. 1 The black and official lira–dollar exchange rates



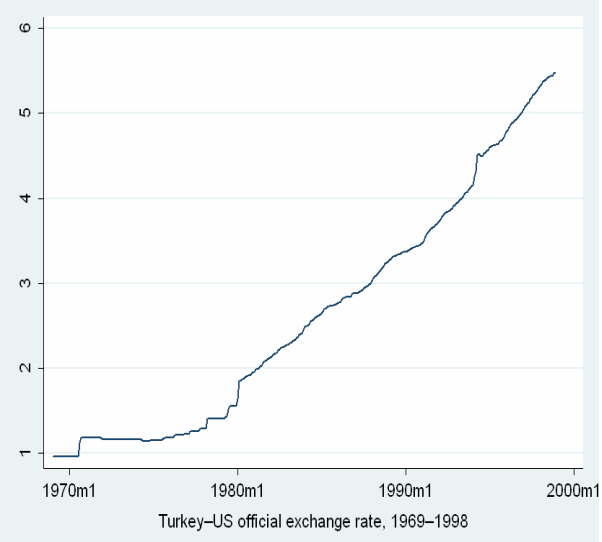


Figure 1 shows the evolution of the black and official lira–dollar exchange rate from 1969 to 1998. As shown, the two series illustrate high similarity.

The plan of the paper will be as follows: In the next section the analytical framework of PPP hypothesis will be developed. Data will be described in section 3 and the empirical results will be presented in section 4. The final section will contain the conclusion.

Analytical Framework

$$ER_R = NE_r \frac{P^*}{P}$$

where ER_R is the real exchange rate, NE_r 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

$$\log(ER_R) = \log(NE_r) + \log(P^*) - \log(P)$$

Following equation shows the model of mean reverting real exchange rate

$$\log(ER_R)_t = \sigma + \phi \log(ER_R)_{t-1} + \varepsilon_t$$

where σ 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 demonstrates 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 the two countries

Data

The black market and official exchange rates data are taken from the study of Reinhart and Rogoff (2004)[4]. Price levels are defined as the logarithm of the price ratio generated by the US CPI (IFS line 64) divided by Turkish consumer price index (CPI) and taken from the International Monetary Fund's International Financial Statistics (IMF-IFS) database. Due to the lack of

[4] Traditionally, US dolar is comon currency for black market exchange rates in the world. Therefore, most empirical studies use US dolar black market exchange rates.

consistent data on the CPI index for Turkey before 1969 M1 and unavailability of data beyond 1998 M12 for black market, the data spans from 1969M1-1998 M12.

Empirical Results

Augmented Dickey- Fuller (ADF) unit root tests were performed to provide a benchmark for our result. The ADF test involves regressing the first difference of a variable on a constant, it's lagged level, and k lagged first differences;

$$\Delta r_t = \mu + pr_{t-1} + \sum_{j=1}^{k} \gamma_j \Delta r_{t-j} + \varepsilon_t$$

Where r_t is the (logarithm of) the real exchange rate. The null hypothesis tested that real exchange rate contains a unit root against the alternative that is level stationary.

The results of the ADF tests for BMREX and OREX are reported in Table 1. The ADF test results provide strong evidence against the unit root null. Since the commonly used Augmented Dickey-Fuller (ADF) test has been criticized for rejecting "stationarity" too often other, more powerful, tests have been suggested such as PP, KPSS and DF-GLS for testing PPP (Oskooee *et al.*, 2008).

The Phillips-Perron test (Phillips-Perron, 1988; PP) is also conducted to ensure the "stationarity" of the BMREX and OREX series. The PP test uses a non-parametric correction to deal with any correlation in error terms. The test results, reported in Table 1, demonstrate that all the data series are stationary. These findings also provide strong evidence for the validity of long run PPP.

Kwiatkowski *et al.* (1992) (henceforth, KPSS) suggest the following test of stationary of a series. In KPSS test, the null hypothesis of "stationarity" is formulated as; $H_o = \sigma_u^2 = 0$. The null hypothesis of trend "stationarity" corresponds to the hypothesis that the variance of random walk is zero. The KPSS test statistics for the hypothesis of trend "stationarity" is given by,

$$LM = \frac{\sum_{t=1}^{T} S_t^2}{\hat{\sigma}_e^2}$$

Where e_t are residuals from the regression of p_t on a constant and a time trend, $\hat{\sigma}_e^2$ illustrates residual variance and S_t is the partial sum process of the

residuals. Using KPSS test results the null hypothesis of no trend stationary real exchange rate cannot be rejected for all cases, indicating BMREX and OREX in Turkey is stationary and support long-run PPP.

By using a newer and more powerful test that is proposed by Elliot, Rothenberg and Stock (1996) (hereafter as ERS), mean reverting behavior of BMREX and OREX is examined. ERS suggest a simple adjustment of the ADF test so that the modified test can nearly achieve the power envelope using Generalized Least Square (GLS) estimation. The resulting DF-GLS test is illustrated to be uniformly the most powerful. Monte Carlo results reported by ERS point out that the power improvement from using the DF-GLS test can be large compared to the standard ADF. The DF-GLS test is also picked as one of the best performing tests in terms of size and power (Zengin, 2001).

The null hypothesis is $H_0 : \partial = 1$ against the local alternative of $H_a : \partial = 1 + \bar{c} / T$. The DF-GLS test is performed by testing hypothesis

$$\Delta r_t^d = \partial_0 r_{t-1}^d + \sum_{j=1}^{k} \partial_j \Delta r_{t-j}^d + \varepsilon_t$$

Where r_t^d is the locally de-trended series of r_t . The DF-GLS statistics is given by the t-ratio and testing $H_0 : a_0 = 0$ against the alternative $H_a : a_0 \langle 0$

Test with and without time trend are both conducted. That's why for cases in with the time trend and without trend are statistically significant at the 1% significance level, the results of DF-GLS are strongly in support of parity reversion in BMREX and OREX.

These unit-root tests are performed on the level of variable. The model with trend and without trend is adopted in the empirical analysis. Test results are presented in Table 1 and Table 2.

Table 1 indicates that ADF, PP and DF-GLS test results cannot reject the null hypothesis of a unit root at the 1% level for the OREX and BMREX.

In addition, KPSS test results reject the null hypothesis at the 1% level. In other words, KPSS test results with trend and without trend illustrate that BMREX and OREX are stationary as illustrated in Table 2. These findings also present strong evidence for the validity of long run PPP by taking BMREX into account for Turkey with ADF, PP, KPSS and DF-GLS tests. Both BMREX and OREX prove the validity of PPP. This could be explained by a high similarity of the series, which could be seen in Figure 1.

Table 1. ADF and PP tests for BMREX and OREX

Series	ADF		PP	
	With Trend	**Without Trend**	**With trend**	**Without Trend**
OREX	-9,462 (1)	-9,474 (1)	-14,931 (8)	-14,947 (8)
BMREX	-9,462 (1)	-9,474 (1)	-14,919 (8)	-14,935 (8)
Critical value (%1)	-3,983	-3,448	-3,983	-3,448

Notes: Numbers in the parentheses are the lags. Optimal lag lengths for ADF and DF-GLS were chosen by Schwarz Information Criterion (SIC)

Table 2. KPSS and DFGLS tests for BMREX and OREX

	KPSS		DFGLS	
Series	**With trend**	**Without Trend**	**With trend**	**Without Trend**
OREX	0,074	0,083	-9,482	-9,462
	(10)	(10)	(1)	(1)
BMREX	0,074	0,083	-9,482	-9,463
	(10)	(10)	(1)	(1)
Critical value (%1)	0,216	0,739	-3,475	-2,571

Notes: Numbers in the parentheses are the lags. Optimal lag lengths for KPSS and PP were chosen by Newey-West Bandwidth.

Conclusions

PPP is tested by using black market exchange rate and compared to the official exchange rate by using standard (ADF, PP), newer and more powerful tests (KPSS, DF-GLS). Over all result implies that all unit root test support PPP in Turkey. Although black market exchange rates in emerging countries have been

very active since official market exchange rates have been distorted by controls, there is no significant difference between the two rates in testing PPP, at least in Turkey.

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