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Is Purchasing Power Parity Hypothesis Reasonable from the View of Trade Blocks and Currency Zones?

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Abstract:

Since the 1980s, many regional agreements have appeared to facilitate trade and spur economic growth. This paper examines whether or not the purchasing power parity (PPP) hypothesis for regional agreements has been satisfied. This study employs a nonlinear unit root test for real exchange rates (RERs). Overall, the test results provide stronger support for PPP than any earlier studies of bilateral PPP for trade/currency integrated countries. When the data for the postintegration period are included, the evidence for PPP becomes more significant. Regional agreements have promoted the PPP hypothesis. KPSS tests provide more evidence for PPP than the ADF and PP tests for the RERs of European Union (EU) countries against the currency of Germany and the euro but not for the RERs against the US dollar. These results show that convergence toward PPP between the EU countries tends to be nonlinear but is likely to be linear for the non-EU and between EU and non-EU industrialized countries. Tracing back to the potential sources of nonlinearity in RERs proposed in existing literature, the RERs of the EU countries are supposed to be less affected by trade barriers and more by official interventions in the foreign exchange market after the introduction of the euro. Also, financial integration seems to have played a more significant role in recent years over the existence of trade barriers.

1. Introduction:

This paper examines issues surrounding whether or not the purchasing power parity (PPP) hypothesis for regional agreements all over the world has been

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satisfied. The PPP hypothesis has been frequently discussed in the past. These discussed have contributed from both the theoretical and empirical views.

Recently, Bahmani-Oskooee, Kutan and Zhou (2008) revisited this hypothesis and showed that PPP for the euro area is significant. Rogers (2007) pointed out that price level convergence is more likely to take place in a single currency area, such as the euro area, than among other countries. Much attention has been paid to this PPP hypothesis. Whether the PPP is satisfied or not is important for policy issues in regional agreements. First, if PPP holds, this means that the effects of a shock to the real exchange rates (RERs) would be only temporary. Second, if PPP holds, it implies that almost no RER risk exists due to price level convergence.[1] Third, although each existing trade block or currency zone seems to be important, if PPP tends to hold better for one block or zone after the introduction of the agreement than other countries, this would imply that PPP may hold better than for other countries that do not participate in such blocks or zones.

Few empirical studies have examined the behavior of real exchange rates not only for the euro area but also for other areas. Alquist and Chinn (2002), Gadea et al. (2004), and Lopez and Papell (2007) employed either panel or univariate, augmented, Dickey-Fuller (ADF) unit root tests to examine the stationarity of RERs for 23 countries and concluded that there is limited support for PPP. Using data from 1976 to 2002 and autoregressive, distributed lag cointegration procedure, Narayan et al. (2007) applied a threshold autoregressive model to examine PPP and provided strong support for PPP in Italy. Baharumshah et al. (2008) found no evidence for the weak form of PPP in the precrisis period but strong evidence in the postcrisis period. Hooi et al. (2007) supported PPP for the Asian countries by using an LM unit root test. Ozdemir (2008) used a nonlinear cointegration technique and found validity for the PPP hypothesis in Turkish real exchange rates with the United States. Drine et al. (2008) employed panel cointegration techniques and verified strong PPP for OECD countries and weak PPP for Middle East and North African countries; however, Drine's study did not verify it for African, Asian, Latin American, and Central and Eastern European countries.

On the other hand, Alquist and Chinn (2002) found that the RER for the euro area is nonstationary, which means that PPP does not hold. Gadea et al. (2004) found some support for PPP in the euro area. Koedijk et al. (2004) employed panel unit root tests to examine this phenomenon. They used a seemingly unrelated regression (SUR) method that allowed heterogeneous serial correlation between the error terms and varying rates of mean reversion across a panel of RERs. They showed that PPP tends to hold in the euro area in general; however, they also showed that different results occur when different currencies are used as the numeraire. Beko et al. (2007) assessed the theory of PPP for the Czech Republic, Hungary and Slovenia. Although this study found cointegration among nominal exchange rates, PPP could not be confirmed for any of the three transition countries.[2]

Methods in this field have recently improved and much information has been provided by employing new, elaborate methods. Although heterogeneous panel unit roots tests employed recently seem to be appropriate for analyses, they cannot account for the accumulating empirical evidence that some RERs tend to exhibit a nonlinear mean revision process. If RERs follow nonlinear stationary processes, the alternative hypothesis of linear stationarity in the ADF tests and panel unit tests would be misspecified.[3] One aim of this paper is to offer ways to avoid this problem.

There seem to be some explanations for why nonlinear adjustments toward PPP are expected. One reason is that international goods arbitrage is not satisfied because of factors such as trade barriers and transportation costs (Michel et al., 1997; Taylor, 2003; Sarno et al., 2004). Another reason for nonlinearity in RERs is a lack of financial integration, which causes nominal and real exchange rates to move away from equilibrium levels (Taylor, 2003; Sarno et al., 2003).

It should be noted that evidence for PPP is sensitive to the sample period. In particular, the introduction of a trade block or a currency zone may influence RERs and PPP. Next, the choice of the numeraire currency is sensitive. Statistical method is also important. This paper takes all these points into account.

2. Methodology and Data:

Dickey-Fuller (DF) and augmented Dickey-Fuller (ADF) tests have been both famous and standard methods widely and frequently used for unit root tests. DF and ADF tests set the null to nonstationarity of a variable against an alternative of stationarity. However, tests for the null hypothesis of stationarity have not yet become part of the standard tools of empirical time series analysts. In many cases, however, the hypothesis of stationarity is more likely than the more frequently used hypothesis of (autoregressive) unit root nonstationarity. If we use only autoregressive unit root (DF) type tests, the hypothesis of stationarity would be only chosen. Most unit root tests have low power against stationarity and highly autoregressive alternatives.

This standard approach often ails to find stationarity. An important argument against the use of tests for the null hypothesis of stationarity is the difficulty of controlling their size when the process is stationary but highly autoregressive. Probably the best known test for stationarity in econometrics, the KPSS test introduced by Kwiatkowski, Phillips et al. (1992), is oversized in that case.[4] In KPSS tests, the null hypothesis is stationary around a deterministic trend. The series is expressed as the sum of deterministic trend, random walk, and stationary error, and the test is the LM test of the hypothesis that the random walk has zero variance. The asymptotic distribution of series is derived under the null hypothesis and if the series is difference-stationary. Finite sample size and power are considered.

Monthly consumer price indices and end-of-period bilateral nominal exchange rates were obtained from the International Financial Statistics of the International Monetary Fund (IMF). The maximum number of lag length is set to 8 according to Kwiatkowski, et al. (KSS, 2003). The basic sample period is from 1980M1 to 2007M12.

The bilateral RERs (rer) with US dollar as numeraire are constructed by

$$rer_{i,US} = s_i + p_i + p_{US} \qquad (1)$$

where s_i is country i's currency price of a dollar, p_i and p_{US} are the price indices of country i and the United States, respectively. Those with German currency and the euro as numeraire are:

$$rer_{i,gm} = s_i - p_i - s_{gm} + p_{gm} \quad (2)$$

where s_{gm} is German currency price of a dollar, respectively. p_{gm} is the price indices of Germany. All these variables are in their logarithm.

For 1999-2007, the dollar exchange rates of the euro area countries are calculated by

$$s_i = s_{euro} + s_j \quad (3)$$

where s_{euro} is the log of the euro price of a dollar and s_j is the log of a euro zone country's currency conversion rate of a euro.

3. Empirical Results:

Tables 1 and 2 show the results of the KPSS tests along with those of the standard ADF and PP (Phillips -Perron) tests for the bilateral RERs. In the case of the euro zone, the US dollar, German currency, and the euro are employed as numeraire currency. All of the tests include constant terms. The data are detrended. Null hypothesis are these: A country has a unit root (ADF and PPP) and a country is stationary). The rejection of the null of nonstationarity by these tests would be the evidence for level stationarity. Failure to do so but ability to reject supports stationarity and the PPP.

Table 1a. Unit Root Test Results for the Bilateral Real Exchange Rates with German Currency as Numaraire before the Introduction of Euro: Euro Zone

	ADF	PP	KPSS
Austria	-2.25	-2.40	0.78***
Belgium	-0.87	-1.05	0.90***
Finland	-0.33	-0.54	0.97***
France	-1.03	-1.05	1.02***
Ireland	-1.01	-0.75	0.19
Italy	-2.19	-2.16	1.01***
Luxembourg	-2.13	-2.08	1.01***
Netherlands	-2.81*	-2.75*	0.93***
Portugal	-1.46	-1.48	1.09***
Spain	-0.55	-1.25	0.53**

Note. *** is significant at 1%, ** is 5%, and * is 10% level. Countries are limited only to first participation countries of the euro.

Table 1b. Unit Root Test Results for the Bilateral Real Exchange Rate with the US dollar as Numaraire before the Introduction of Euro: Euro Zone

	ADF	PP	KPSS
Austria	-2.67	-2.68*	0.86**
Belgium	-2.88*	-3.10**	0.88***
Finland	-1.46	-1.64	0.69**
France	-2.12	-1.71	0.99**
Germany	-1.16	-1.09	0.22
Ireland	-2.13	-2.08	1.01***
Italy	-2.02	-2.16	0.29
Luxembourg	-1.88	-1.66	0.93***
Netherlands	-1.96	-1.94	0.97***
Portugal	-1.34	-.133	1.05***
Spain	-0.15	-0.22	1.01***

Note. *** is significant at 1%, ** is 5%, and * is 10% level.

Table 1c. Unit Root Test Results for the Bilateral Real Exchange Rates after the Introduction of the Euro: Euro Zone

	ADF	PP	KPSS
Austria	-1.14	-1.35	0.95***
Belgium	-1.04	-1.04	0.95***
Finland	-1.62	-1.51	1.02***
France	-1.32	-1.32	1.02***
Germany	-1.88	-1.89	1.04***
Ireland	-2.57	-2.46	0.57**
Italy	-1.22	-1.19	1.02***
Luxembourg	-2.26	-2.12	0.58**
Netherlands	-1.71	-1.77	0.44*

Portugal	-1.71	-1.74	1.06***
Spain	-1.97	-1.97	1.06***

Note. *** is significant at 1%, ** is 5%, and * is 10% level.

Table 2a. Unit Root Test Results for the Bilateral Real Exchange Rates with Each Currency before the Introduction of Trade Block and Currency Zone

	ADF	PP	KPSS
ASEAN (Trade Block)			
Brunei	-1.65	-1.65	1.03***
Cambodia	-1.51	-1.51	0.98***
Lao	-3.56***	-3.29**	0.27
Myanmar	-3.38**	-3.13**	0.58**
Vietnam	-2.46	-2.21	0.94***
MERCOSUR (Trade Block)			
Argentina	-1.97	-1.99	0.28
Brazil	-1.72	-1.67	0.69**
Paraguay	-1.59	-1.75	0.40*
Uruguay	-2.30	-2.19	0.75***
NAFTA (Trade Block)			
Canada	0.59	-0.46	0.83***
Mexico	-0.98	-0.98	0.90***
WAEMU (Currency Zone)			
Benin	-1.61	-1.61	0.99***
Burkina	-1.00	-3.12**	0.71**
Cote	0.66	0.29	1.07***
Guinea	-2.74*	-2.75*	0.34
Mali	-1.91	-5.52***	0.26

Niger	-1.67	-5.31***	0.25
Senegal	-1.71	-5.38***	0.29
Togo	-1.96	-5.36***	0.26

Note. *** is significant at 1%, ** is 5%, and * is 10% level. Countries are limited only to new comers form the 1980s.

Table 2b. Unit Root Test Results for the Bilateral Real Exchange Rates with Each Currency after the Introduction of Trade Block and Currency Zone

	ADF	PP	KPSS
ASEAN (Trade Block)			
Brunei	-1.21	-1.21	0.85***
Cambodia	-1.21	-1.26	0.82***
Lao	-2.05	-2.75*	0.33
Myanmar	-0.79	-0.80	1.03***
Vietnam	-2.13	-2.08	1.01***
MERCOSUR (Trade Block)			
Argentina	-1.95	-1.91	0.93***
Brazil	-1.46	-1.64	0.47**
Paraguay	-1.73	-5.30***	0.59**
Uruguay	-0.84	-0.78	1.05***
NAFTA (Trade Block)			
Canada	-2.10	-2.09	0.85
Mexico	-1.72	-1.76	0.69**
WAEMU (Currency Zone)			
Benin	-1.82	-2.02	0.49**
Burkina	-2.13	-2.08	1.01***
Cote	-0.57	-0.55	1.11***

Guinea	-0.18	-0.33	1.07***
Mali	-1.58	-1.58	0.57**
Niger	-1.30	-1.31	0.98***
Senegal	-0.34	-0.34	1.08***
Togo	-1.98	-1.97	0.98***

Note. *** is significant at 1%, ** is 5%, and * is 10% level.

Note that a level stationary RER is consistent with PPP in strict form whereas trend-stationary RERs would be consistent with a modified view of PPP, which allows the long-run (equilibrium) RERs to vary around a linear trend. The presence of such a trend in RERs may reflect the well-known Balassa-Samuelson type effects, resulting from the differential rates of productivity growth in traded and nontraded goods sectors of a country relative to that of the country whose currency is used as a numeraire currency in measuring RERs.

The results show that during the after trade/currency integration period, the null hypothesis of nonstationary RERs is almost rejected. The results suggest that there is evidence for PPP for most of the countries in the study. The introduction of trade block/currency integration has promoted to the PPP hypotheses. It is interesting to note that evidence for stationary RERs in the EU is stronger for the rates versus the US dollar than those versus the German mark, which implies that the 1990 German unification may have somewhat slowed down the convergence toward PPP.

The findings are not very clear; however, they shed light on our understanding of two other important matters. One is that the case of developed countries fits the PPP hypothesis more than the case of developing countries. As economic activity increases and market integration continues, the PPP in general seems to be satisfied. The other matter is the difference between trade block and currency zone, which seems that developed ones are better than the cases of developing ones. Some cases are not very clear. There is one possibility that the sample periods and the cases are not enough. As explained above, the results are

different for developed versus developing countries. This fact may have influenced the results.

Comparing the results of the KPSS tests with those of the other tests, the results of the KPSS tests show more evidence to reject the null of nonstationarity. However, when the RERs are expressed with respect to the US dollar, the ADF and PP tests (not the KPSS tests) shows more evidence to reject the null. These results show that convergence toward PPP between the EU countries, especially in the euro area, tends to be nonlinear.

Overall, the results provide support for PPP for after the period of trade/currency integration. There is evidence of rejecting the null of nonstationary RERs by the tests at the 10 percent level for most of the RERs with all three numeraire currencies.

4. Conclusions:

This paper examined whether PPP holds better after the adoption of trade/currency integration. Overall, the test results provide stronger support for PPP than any earlier studies of bilateral PPP for trade/currency integrated countries. When the data for the post-integration period is examined, the evidence for PPP becomes more significant. We can conclude that the integration has played an essential role for better performance of the PPP within the area; however, we cannot say clearly that PPP holds better within a single currency than between other currencies.

KPSS tests provide more evidence for PPP than the ADF and PP for the RERs of EU countries against the currency of Germany but not for the RERs against the US dollar. These results show that convergence toward PPP between the EU countries tends to be nonlinear but is likely to be linear for non-EU and between EU and non-EU industrialized countries. Tracing back to the potential sources of nonlinearity in RERs proposed in the existing literature, the RERs of EU countries are supposed to be affected less by trade barriers but more by official interventions in the foreign exchange market after the introduction of the euro. Finally, financial integration seems to have played a more significant role in recent years than the existence of trade barriers.

Notes:

1. This point is important not only for policymakers but also from the point of view of asset pricing and portfolio managements (Koedijk et al., 2004).
2. In general, PPP seems to hold in developed countries, but not developing ones, however, there are many exceptions. See, for example, Dame et al. (2008).
3. Lopez and Papell (2007) produced different results when they allowed different rates of mean revision procedures.
4. Bahmani-Oskooee et al. (2008) applied KSS methodology to the RERs of 88 developing countries.

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