Kashmir Economic Review
ISSN(P): 1011-081X, ISSN(E): 2706-9516
http://www.ker.org.pk

A Structural Break Unit Root Test to Test Purchasing Power Parity Hypothesis: An Empirical Analysis of South Asian Economies

ABSTRACT

The purchasing power parity hypothesis is evaluated through examination of whether real exchange rate exhibits mean-reverting behavior implying that any transient deviations from its equilibrium level will eventually converge with the mean value. Traditional unit root tests like Augmented Dickey-Fuller (ADF) test usually fail to reject null hypothesis about unit root in the situation of structural breaks. Hence, this study utilizes structural break test for south Asian countries (Bhutan, Bangladesh, China, Maldives, Nepal, Pakistan, and Sri Lanka) with the objective of finding out if there are structural breaks in data collected annually from 1991 until 2023. In this research study we have used Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, Augmented Dickey Fuller (ADF) test, and structural break unit root break test. The unit root tests with structural breaks indicate that for Bhutan, China, the Maldives, Nepal, Pakistan, and Sri Lanka, the null hypothesis of a unit root cannot be rejected at the 5% significance level, regardless of the model used (IO or AO). This means that the actual price levels for these countries follow a non-stationary trend and PPP is not proved true. But in case of Bangladesh, the AO model disposes off null hypothesis therefore suggesting stationarity and supporting PPP. While for India, both models eliminate null hypothesis which confirms stationarity and thus supports PPP within the sampled period.

AUTHORS

Shahid Akbar *
Assistant Professor, Department of Economics, The University of Lahore, Lahore, Pakistan.
Author's Contributions: 1,3,4,5,6
shahid.akbar@econ.uol.edu.pk
https://orcid.org/0000-0001-7174-5358

Muhammad Iqbal
Assistant Professor, Department of Economics, University of Mianwali, Mianwali, Pakistan.
Author's Contributions: 2,6,7
muhammad.iqbal@umw.edu.pk
https://orcid.org/0000-0002-5256-3003

Farzana Munir *
Assistant Professor, School of Economics, Bahauddin Zakariya University, Multan, Pakistan.
Author's Contributions: 2,4,6,7,8
farzanamunir@bzu.edu.pk
https://orcid.org/0000-0003-0142-8028

Keywords

Structural break unit root test, Exchange rate, Purchasing Power Parity, South Asian Economies

JEL Classification

B22, C12, E31, F31

Please cite this article as:

Akbar, S., Iqbal, M., & Munir, F. (2024). A structural break unit root test to test purchasing power parity hypothesis: An empirical analysis of South Asian economies. *Kashmir Economic Review*, 33(1), 14-23.

*** Correspondence author**

Author's contribution in the article: 1- Conceived and designed the analysis, 2- Reviewed and compiled the literature, 3- Collected the data, 4- Contributed data or analysis tools, 5- Performed the analysis, 6- Wrote the paper, 7- Financial support for the conduct of the study, 8-Other

1. INTRODUCTION

Purchasing power parity (PPP) refers to the rate at which a single nation's currency must be converted in order enable other countries to purchase the same amount of products and services. We use it to compare the standard of living and economic output of different nations. According to Cassel (1918), when two nations engage in complete and free commerce, the real exchange rate cannot deviate significantly from PPP. Exchange rates and local and international pricing must be considered while examining the validity of PPP. The real exchange rate results from adjusting the nominal exchange rate to a comparable price. The nominal exchange rate is the price of one currency in terms of another (Sarno & Taylor, 2002; MacDonald, 2007). If we allow non-stationarity, we can additionally employ the real exchange rate for assessing PPP. If a real exchange rate is nonstationary (has unit root), it would imply that in theory too much time would have to pass before long term consequences of relevant shocks would lead to the movement of variable away from its long-run equilibrium. In contrast if real exchange rate has constant value without any unit roots ultimately diseases will vanish which will make it capable of attaining balanced position after some time (Cuestas & Regis, 2013). In exchange rate economics, one of the most hotly contested problems is the divergence of the real exchange rate over short and long terms (Dornbusch & Krugman, 1976; Rogoff, 1996).

According to the principle known as "Purchasing Power Parity," when two currencies' exchange rates are balanced, their buying power is equal in both nations. In order to go back to PPP contagion model states that country facing inflation will have higher internal prices which mean devaluation should take place on currency. In other words under this setting commodities that are alike irrespective of their price differences across borders have same costs provided there are no trade barriers or geographical distances between nations. Under situations where there is no arbitrage, there would be no excessive requirement of foreign money hence no fluctuations in its rate; thus, PPP might fail to work well for nations less openly trading and countries that are far apart from each other (Alba & Papell 2005). Absolute up means that the purchasing power of a single unit of foreign currency remains the same as in the local economy (Saeed et al., 2012). On the other hand, relative PPP shows how variations in nominal exchange rates between two or more currencies can offset variations in national price levels, including inflationary trends or deflationary tendencies (Arize, 2011). Researchers have conducted numerous studies to assess the effectiveness of PPP, especially following the 1973 Brettonwood system disaster. Investigations into why relative PPP does not hold up in both the short and long term are currently ongoing (Nusair, 2003).

Primary objective of this research study is to examine the consequence of NEER and CPI on PPP, and also check whether there is any structural break in the data of South Asian countries (Bhutan, Bangladesh, China, Maldives, Nepal, Pakistan, Sri Lanka).

2. LITERATURE REVIEW

Different countries have looked into PPP hypothesis by employing different statistical techniques, sample lengths and data frequencies. ADF unit root test as well as Johansen’s co-integration test were used by Kasem and Al-Gasaymeh (2022) to analyze quarterly data for Qatar, Iraq, Turkey, Saudi Arabia and United Arab Emirates from 2000 to 2020 located in Middle East region. The co-integration linked between the exchange rate and the levels of local and international prices for the chosen nations was present. As a result, exchange rates interacted dynamically to correct deviations from the equilibrium co-integrating relationship and return the system to long-term equilibrium. To the Jordan Economy, these countries are related, and this proves the PPP model has a long-run validity.

The study by Choji and Manga (2017) employed time series tests to determine if PPP holds for a number of five Asian countries from 1996 to 2016 using monthly data. They used co-integration and time series

unit root techniques to determine PPP. Their initial evaluation of the variables' stationarity revealed that they are unit root at levels, but becomes stationary when taking first difference. They then used the co-integration test to determine the stationary nature of our variables over the long term. Four out of five countries' co-integration test results rejected the null hypothesis, implying that there is enough evidence to support public-private partnerships in these Asian nations in a long-run between the years 1996 to 2016. In different wording, rejecting null hypothesis means that relative prices and nominal exchange rates have a long-lasting relationship.

Raza et al. (2022) determined if Asian and developed economies have long-term buying power parity. They observed that these nations determined their long-term exchange rates facilitated the creation of efficient monetary policies. Further, they examined the long-term PPP connections between the UK, the US, and the Asian economies (China, Japan, and Singapore). It was crucial to use time-series analysis to examine whether PPP holds between the economies of the UK, the US, and those of Asia. By analyzing the complete samples before global financial crisis and subsamples after, they utilized Johansen co-integration test to investigate relative PPP between these nations. In the full sample and in subsamples, they found that relative PPP shares Asian economies (Japan, China and Singapore) with US and UK respectively. The study provided strong evidence in favor of PPP hypothesis arguing that the US and UK prices have effects on domestic pricing in Asian countries as well as contributing greatly to the variance of such prices and inflation levels.

Khan and Ahamad (2005) examined the short-term behavior of the exchange rate and comparable prices for four Asian nations to assess PPP as a long-term equilibrium condition. The study examined data for three different price indices from 1976 to 2001 using a co-integration technique. The study showed empirical evidence for the absence of a co-integrated connection in the collected data. Most of the time, the study's findings contradict the PPP hypothesis. Ahmad et al. (2006) looked at PPP for four South Asian countries using monthly data on nominal exchange rates, CPI, and WPI from 1984 to 2002 by using the mean reversion hypothesis and the Engle-Granger co-integrating relationship. PPP does not hold in any of the nations, according to the mean reversion hypothesis findings. The results of the co-integration investigation specify that PPP is only applicable in a weakened form in Pakistan. There is substantial evidence that PPP does not exist in Bangladesh, while the data for India and Sri Lanka is limited.

She et al. (2021) empirically investigated the validity of PPP in Pakistan. The study employed the Fourier ADF (FADF) and Fourier KPSS (FKPSS) unit root tests to analyze the unit root qualities of Pakistan's real exchange rates (RERs) against its 21 main trade partners from 1983Q1 to 2014Q4. They used Fourier unit root tests because they account for the nonlinearity of the data and numerous transient structural breaks. By means of three RER series, the FADF test rejects the non-stationary null hypothesis. Conversely, nine RER series are rejected at stationary null by the FKPSS test. Therefore, according to FKPSS test; PPP theory is supported in 12 exchange rate series while its support in 3 exchange rate series is confirmed through FADF unit root test. Robust analysis also employed regression analysis to estimate the PPP equation. For nine exchange rate series, the regression findings demonstrated the validity of the PPP hypothesis. These results implied that Pakistan's PPP hypothesis partly holds.

Muhammad et al. (2009) aimed to investigate the buying power parity theory in Pakistan. The research used the mean reversion hypothesis to explain the variation in the CPI, WPI, and NEER during the years 1980–2008. They tested the PPP using the Engle-Granger co-integration and error correction mechanisms. The results of the study revealed that the mean reversion hypothesis does not substantiate PPP, whilst the co-integration analysis asserted that PPP is applicable but not persuasive on the part of Pakistan. Furthermore, an evaluation of error correction mechanism (ECM) bolstered short-run dynamics of the model.

Sher and Khan (2019) using annual exchange rate data from 1980 to 2012, research investigated to revalidate the PPP hypothesis in Pakistan. They verified the long-run PPP hypothesis using the Zivot-Andrews unit root test and the ADF test. According to the findings, there was no evidence supporting the PPP hypothesis for Pakistan in the ADF test. In contrast, PPP theory was found to be supported by Zivot-Andrews unit root test for some structural breaks. The conclusion contradicted previous studies that reported no evidence in favor of PPP. Future research applied to elaborate time-series models to analyze the PPP theory in other emerging economies.

Madhavikas (2021) studied the strong and weak correlations between macroeconomic factors and PPP between Pakistan and Sri Lanka. Similar products from both countries were compared to get the value for PPP based on yearly macroeconomic statistics for 20 years, spanning from 1997 to 2016. They examined the data using descriptive statistics, reliability tests, and time series multiple regression. The real exchange rate was not constant in either the Sri Lankan or Pakistani economies. In contrast, Pakistan exhibited a strong correlation between the PPP and the selected macroeconomic variables, while Sri Lanka had a weak correlation with the inflation, interest rate, money supply, exchange rate, foreign direct investment, and gross domestic product. The study added to the existing literature on the relationship between economic growth and PPP.

3. DATA AND ITS SOURCES

In this research an analysis of the PPP hypothesis is done for the South Asian countries (Bhutan, Bangladesh, China, Maldives, Nepal, Pakistan, Sri Lanka) through yearly data covering the period from 1991 to 2023. The information was obtained from International Financial Statistics (IFS).

3.1 Unit Root Test for Examining the PPP Hypothesis with Structural Breaks

The PPP hypothesis is tested by checking whether the real exchange rate is mean-reverting, which means that deviations from the equilibrium level are only temporary and will revert back to the mean in the long run. Traditional tests for unit root such as ADF and KPSS often fail to reject the null hypothesis of unit root in presence of structural breaks. In this case, a structural break unit root test could offer a better way to deal with the PPP hypothesis.

Financial time series data, such as exchange rates tend to experience sudden changes due to major market events, policy shifts or other factors. As a result, there might be structural changes that require proper consideration in order not to produce misleading conclusions. Structural break unit root tests including Zivot-Andrews test or Perron test allow for one or more endogenously determined breaks in the series thereby providing an accurate detection of unit roots under changing circumstances.

3.2 Zivot-Andrews Unit Root Test

This particular examination enables the occurrence of only one structural break in both the intercept and slope or either of them alone. It is particularly useful when the timing of the break is unknown and needs to be determined endogenously.
Theoretical framework

$$\Delta y_t = \mu + \beta t + \theta y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta y_{t-i} + \delta D_t + \alpha DU_t + \epsilon_t \quad (1)$$

Where D_t is a dummy variable for the break in the intercept, andDU_t is a dummy variable for the break in the trend.

3.3 Perron Unit Root Test

This test incorporates many structural fractures and can be used in contrasting situations such as change of mean level, trend or both.

$$\Delta y_t = \mu + \beta t + \theta y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta y_{t-i} + \delta_1 D_{t,1} + \delta_2 D_{t,2} + \alpha_1 DU_{t,1} + \alpha_2 DU_{t,2} + \epsilon_t \quad (2)$$

Where $D_{t,1}$ and $D_{t,2}$ are intercept break dummy variables, $DU_{t,1}$ and $DU_{t,2}$ are trend break dummy variables.

3.4 Application to PPP

When real exchange rate data is subjected to unit root tests with structural breaks, it becomes easy to assess if PPP hypothesis is applicable despite structural adjustments. This is because by determining when breaks occur you will have an idea about the dynamics of currency rates and the extent to which PPP holds over different time spans.

In circumstance where structure breaks exist it is advisable to follow structural break root tests rather than conventional unit root tests when testing for PPP hypothesis. This approach reflects structural shifts in the data and yields more precise and trustworthy results. The findings from these tests could greatly increase our knowledge on how currency rates behave; consequently improving finance strategies as well as risk management techniques in global commerce.

4. RESULTS AND DISCUSSION

For conducting assorted tests, this section applies first the one with intercept alone and also on the trend and intercept ADF test, KPSS Test.

Table 1: Augmented Dickey-Fuller (ADF) Test Results with Intercept Only (Level)

Variables	Lags	With Intercept Only (Level) Test Statistic (Critical Value At 5%)	Results
REER_BHU	7	-1.69 (-2.96)	Significant
REER_BNG	7	-1.00 (-2.96)	Non-Stationarity
REER_CH	7	-1.13 (-2.96)	Non-Stationarity
REER_IND	7	-1.01 (-2.96)	Non-Stationarity
REER_MALD	7	-1.81 (-2.96)	Non-Stationarity
REER_NEP	7	-0.72 (-2.97)	Non-Stationarity
REER_PAK	7	0.19 (-2.96)	Non-Stationarity
REER_SL	7	-1.69 (-2.96)	Non-Stationarity

Source: Author's own calculations

The ADF test checks whether or not time series have unit roots which implies non-stationarity. If the test statistic exceeds the critical value, the null hypothesis of a unit root is rejected, demonstrating stationarity and showing that the PPP hypothesis exists. In this investigation, the ADF test findings for numerous nations are given. The ADF test of Real Effective Exchange Rate (REER) reveals that not one of the series is stable at the level of intercept alone. For Bhutan (REER_BHU), the test statistic is -1.69 greater than the critical value of -2.96 causing a non-rejection of null hypothesis and thus non-stationarity indicating that PPP hypothesis does not hold true. Bangladesh (REER_BNG) has -1.00 test statistic which is higher than -2.96 indicating failure to accept the PPP hypothesis. In a similar way the test results for China (REER_CH: -1.13), India (REER_IND: -1.01), Maldives (REER_MALD: -1.81), Nepal (REER_NEP: -0.72), Pakistan (REER_PAK: 0.19), and Sri Lanka (REER_SL: -1.69) all demonstrate test statistics exceeding the critical value of -2.96 (or -2.97 for Nepal), showing that PPP hypothesis does not hold for none of them.

Table 2: KPSS Test Results with Intercept Only

Variables	Bandwidth	With Intercept Only (Level) Test Statistic (Critical Value At 5%)	Results
REER_BHU	4	0.359 (0.463)	Stationarity
REER_BNG	4	0.405 (0.463)	Stationarity
REER_CH	4	0.527 (0.463)	Non-Stationarity
REER_IND	4	0.538 (0.463)	Non-Stationarity
REER_MALD	4	0.082 (0.463)	Stationarity
REER_NEP	4	0.530 (0.463)	Non-Stationarity
REER_PAK	4	0.755 (0.463)	Non-Stationarity
REER_SL	4	0.500 (0.463)	Non-Stationarity

Source: Author's own calculations

KPSS tests are used for determining whether certain series is stationary or not; if the test statistic is lesser than its critical value then null hypothesis of stationarity fails to be rejected meaning the series is stationary implying PPP hypothesis holds true. As for Bhutan (REER_BHU), the test statistic is 0.359, lower than the critical value of 0.463 hence null-hypothesis cannot be rejected implying that REER_BHU is a stationary process. Similarly, Bangladesh (REER_BNG) has a test statistic of 0.405 which is also less than its critical value indicating stationarity. On the other hand, China (REER_CH) and India (REER_IND) have null-hypothesis rejecting test statistics of 0.527 and 0.538 respectively both greater than their critical values suggesting non-stationarity. With a value of 0.082, the Maldives (REER_MALD) is much lower than the critical value, hence the test indicates that it is stationary. In contrast, Nepal (REER_NEP), Pakistan (REER_PAK) and Sri Lanka (REER_SL) have test statistics that exceed the critical values in their respective cases, namely 0.530, 0.755 and 0.500. Hence, we reject the null hypothesis for these nations, implying that their REER series are non-stationary.

Table 3: Unit Root with Break Test (Intercept Only)

Variables	Lags	Break Date		Intercept only, test statistic (critical value at 5%)	
		IO*	AO*	Innovational outlier	Additive outlier
REER_BHU	7	2006	2006	-3.67(-4.44)	-3.73 (-4.44)
REER_BNG	7	2014	2008	-3.98 (-4.44)	-6.13 (-4.44)
REER_CH	7	2007	2007	-3.92 (-4.44)	-3.98 (-4.44)
REER_IND	7	2006	2006	-4.62 (-4.44)	-4.59 (-4.44)
REER_MALD	7	2011	2007	-3.29 (-4.44)	-3.96 (-4.44)
REER_NEP	7	2006	2009	-3.47 (-4.44)	-3.49 (-4.44)
REER_PAK	7	2007	2016	-2.30 (-4.44)	-1.16 (-4.44)
REER_SL	7	2010	2007	-3.47 (-4.44)	-3.47 (-4.44)

Source: Author's own calculations

This test assesses the presence of unit roots while accounting for structural breakdowns. For Bhutan (REER_BHU), with a break date of 2006, both the IO test statistic (-3.67) and AO test statistic (-3.73) are more than the critical value of -4.44, suggesting that we fail to reject the null hypothesis, implying non-stationarity despite the structural break. In Bangladesh (REER_BNG), the break dates are 2014 (IO) and 2008 (AO). The IO test statistic (-3.98) is more than the critical value, indicating non-stationarity, but the AO test statistic (-6.13) is less than the critical value, implying stationarity at the structural break. The break date for China (REER_CH) in this instance is 2007 and both test statistics (–3.92 IO and –3.98 AO respectively) surpass the critical value implying failure to reject null hypothesis suggesting non-stationarity post-break.

Meanwhile, India's (REER_IND) break date is in 2006 with both test statistics (–4.62 IO and –4.59 AO respectively) being lower than the critical value indicating that there is stationarity with structural breakage. For the Maldives (REER_MALD), this means two break dates; one being 2011 for (IO), while the other is

2007 for (AO). Therefore, both test statistics (-3.29IO, -3.96 AO) surpass the limit showing it is not stationary. In Nepal (REER_NEP), the break dates are 2006 (IO) and 2009 (AO) giving their score of both are greater than critical value (-3.47 IO, -3.49AO) by indicating non-stationarity despite structural breakage being evident through both symptoms exhibited currently.

Finally, Pakistan (REER_PAK) has break dates in 2007 (IO) and 2016 (AO) whose test statistics (-2.30 IO, -1.16 AO) also exceed those limits meaning that we accept this hypothesis hence declining stationarity. Similarly Sri Lanka (REER_SL) which has two moments out of 2010 (IO) for the first one but then support with 2007(AO) second concerning tests whose figures (-3.47 IO, -3.47AO) do not attain critical measuring thus indicating lack of stability even though they experience structural break altogether.

Table 4: Augmented Dickey-Fuller (ADF) Test Results with Intercept & Trend (Level)

Variables	Lags	With Intercept & Trend (Level) Test Statistic (Critical Value At 5%)	Results
REER_BHU	7	-2.206 (-3.563)	Non-Stationarity
REER_BNG	7	-1.670 (-3.563)	Non-Stationarity
REER_CH	7	-1.501 (-3.563)	Non-Stationarity
REER_IND	7	-2.318 (-3.588)	Non-Stationarity
REER_MALD	7	-1.767 (-3.588)	Non-Stationarity
REER_NEP	7	-2.009 (-3.588)	Non-Stationarity
REER_PAK	7	-4.086 (-3.563)	Stationarity
REER_SL	7	-3.305 (-3.588)	Non-Stationarity

Source: Author's own calculations

The ADF test was performed using both an intercept and a trend. This emphasizes on the fact that there is critical value which is -3.563, thus this suggest a conclusion of non-stationarity by failing to reject the null hypothesis in case of Bhutan (REER_BHU) with a test statistic equal to -2.206. Moreover, regarding Bangladesh (REER_BNG), a test statistic measuring -1.670 shows that it possesses a non-stationarity property because it surpasses its crucial value. Therefore, on China (REER_CH), the results tell that there exists a non-stationarity because its test statistic measuring -1.501 surpasses its critical value.

Besides, India's (REER_IND) test statistic measuring -2.318 surpasses its critical value of -3.588 indicating non-stationarity. The result in the Maldives (REER_MALD) is similar, with a test statistic of -1.767, indicating non-stationarity since we fail to reject the null hypothesis. Nepal's (REER_NEP) test statistic of -2.009 is greater than the critical value of -3.588, indicating non-stationarity. On the other hand, Pakistan (REER_PAK) has a test statistic of -4.086, which is less than the threshold value and leads to rejection of the null hypothesis thus indicating stationarity Finally, Sri Lanka (REER_SL) also has a test statistic at -3.305 which is greater than the threshold at -3.588 indicating that it is impossible to reject this hypothesis so it has non-stationary behavior.

Table 5: Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test Results with Intercept & Trend

Variables	Bandwidth	With Intercept Only (Level) Test Statistic (Critical Value At 5%)	Results
REER_BHU	4	0.105 (0.146)	Stationarity
REER_BNG	4	0.179 (0.146)	Non-Stationarity
REER_CH	4	0.098 (0.146)	Stationarity
REER_IND	4	0.109 (0.146)	Stationarity
REER_MALD	4	0.072 (0.146)	Stationarity
REER_NEP	4	0.128 (0.146)	Stationarity
REER_PAK	4	0.055 (0.146)	Stationarity
REER_SL	4	0.499 (0.146)	Non-Stationarity

Source: Author's own calculations

The KPSS test, which takes into account both an intercept and a trend, yields the following results. For Bhutan (REER_BHU), the test statistic of 0.105 is less than the critical value of 0.146, indicating that we cannot reject the null hypothesis, implying stationarity. Nonetheless, in Bangladesh (REER_BNG), the test statistic being 0.179 has been found out to be higher than the critical value thus we reject our initial assumption; this shows lack of constancy in the system. For China (REER_CH), since its test statistic is 0.098 which is lower than the critical value then it indicates stability. In case of India (REER_IND) since its test statistic value is 0.109 below the critical threshold; it demonstrates stable condition. Likewise, when we look at Maldives (REER_MALD), it has got a test score of 0.072 which means that there is stationarity in it. Furthermore for Nepal (REER_NEP), its testing figure of 0.128 which is less than the critical point also points to constancy within it. Pakistan (REER_PAK) has a test statistic equal to 0.055 being lower than the defined limit thus depicting constant behavior. Lastly this paper looks at Sri Lanka where these conditions hold with a value equal to 0.499 underpinned by right critical number 0.146 implying instability since such numbers exceed stipulated margins.

Table 6: Unit Root with Break Test (Intercept & Trend)

Variables	Lags	Break Date		Intercept & Trend, test statistic (critical value at 5%)	
		IO*	AO*	Innovational outlier	Additive outlier
REER_BHU	7	2006	2006	-3.67(-4.44)	-3.73 (-4.44)
REER_BNG	7	2014	2008	-3.98 (-4.44)	-6.13 (-4.44)
REER_CH	7	2007	2007	-3.92 (-4.44)	-3.98 (-4.44)
REER_IND	7	2006	2006	-4.62 (-4.44)	-4.59 (-4.44)
REER_MALD	7	2011	2007	-3.29 (-4.44)	-3.96 (-4.44)
REER_NEP	7	2006	2009	-3.47 (-4.44)	-3.49 (-4.44)
REER_PAK	7	2007	2016	-2.30 (-4.44)	-1.16 (-4.44)
REER_SL	7	2010	2007	-3.47 (-4.44)	-3.47 (-4.44)

Source: Author's own calculations

This test accounts for structural breaks with both an intercept and a trend that results in the following outcomes. The test statistics for both the IO and AO in Bhutan (REER_BHU) are (-3.67 and -3.73) which are greater than the critical value of -4.44 suggesting that the null hypothesis cannot be rejected showing that there is non-stationarity although there was a structural break in 2006. In Bangladesh (REER_BNG), however; the IO test statistic (-3.98) surpasses the critical value thus indicating that it is non-stationary while AO test statistic (-6.13) is less than the critical value implying it's stationary when we consider its structural break (2008). China's (REER_CH) IO and AO test statistics (-3.92 and -3.98) are both more than the critical value, showing non-stationarity despite the structural rupture in 2007. For India (REER_IND), both test statistics (-4.62 and -4.59) are less than the critical value, indicating that we reject the null hypothesis and confirm stationarity after accounting for the break in 2006. In the Maldives (REER_MALD), both the IO and AO test statistics (-3.29 and -3.96) surpass the critical value, indicating non-stationarity despite the 2011 and 2007 breaks. Nepal's (REER_NEP) test results (-3.47 and -3.49) are likewise over the critical level, showing non-stationarity despite structural breakdowns in 2006 and 2009. In Pakistan (REER_PAK), the IO and AO values (-2.30 and -1.16) are both greater than the critical value which indicates non-stationarity in spite of interruptions in 2007 and 2016. Finally, Sri Lanka (REER_SL) has test statistics (-3.47) that are above the critical value, indicating non-stationarity in spite of structural breaks in 2010 and 2007.

5. CONCLUSION AND POLICY IMPLICATIONS

The unit root tests with structural breaks show that for Bhutan, China, Maldives, Nepal, Pakistan, and Sri Lanka, at 5% significance level null hypothesis of unit root can't be rejected for any model (IO or AO). This means that real exchange rates for these countries behave like random walks and thus do not conform

to the Purchasing Power Parity (PPP) hypothesis. However, in case of Bangladesh; from AO model the null hypothesis is rejected indicating stationarity which confirms PPP. For India; under both models null hypothesis gets rejected indicating stationarity thereby confirming PPP during entire sample period.

The results of the unit root tests with structural breaks clearly show that real exchange rates for Bhutan, China, the Maldives, Nepal, Pakistan, and Sri Lanka show a random walk behavior, suggesting that Purchasing Power Parity (PPP) deviations are erratic and persistent. The assertion that PPP may persist over time is however supported by unchanging real exchange rates in Bangladesh. On the other hand, stagnant real exchange rates in India is a factor that also supports PPP. In light of these findings, the policy makers of Bhutan, China, Maldives, Nepal, Pakistan and Sri Lanka are advised to initiate economic policies that will address structural issues affecting exchange rates as well seek to better stabilize currency movements. Meanwhile, for Bangladesh and India to strengthen the conditions for possible enduring PPP, they need to consider price stability and competitiveness enhancing measures. Therefore this will help ensure a more stable exchange rate booting international trade relations thereby enhancing its stability.

Acknowledgment
The authors acknowledge the comments made by the reviewers and members of the editorial board on the earlier version of this manuscript.

Funding Source:
The author(s) received no specific funding for this work.

Conflict of Interests:
The authors have declared that no competing interests exist.

REFERENCES

Alba, J. D., & Papell, D. H. (2007). Purchasing power parity and country characteristics: Evidence from panel data tests. *Journal of Development Economics*, 83(1), 240-251.

Arize, A. C. (2011). Purchasing power parity in LDCs: An empirical investigation. *Global Finance Journal*, 22(1), 56-71.

Asab, M. Z., Abdullah, M., Nawaz, M., Shakoor, M. I., & Arshad, U. (2015). Testing Purchasing Power Parity: A Comparison of Pakistan and India. *International Journal of African and Asian Studies*, 6(4), 48-88.

Cassel, G. (1918). Abnormal deviations in international exchanges. *The Economic Journal*, 28(112), 413-415.

Choji, N. M., & Manga, E. (2017). *Purchasing Power Parity Theory from 1996-2016: Time Series Approach*.

Cuestas, J. C., & Regis, P. J. (2013). Purchasing power parity in OECD countries: Nonlinear unit root tests revisited. *Economic Modelling*, 32, 343-346.

Dornbusch, R., Krugman, P., & Cooper, R. N. (1976). Flexible exchange rates in the short run. *Brookings Papers on Economic Activity*, 1976(3), 537-584.

Janjua, S. A., & Ahmad, E. (2006). Tests of purchasing power parity for South Asian countries. *Pakistan Economic and Social Review*, 235-243.

Kasem, J., & Al-Gasaymeh, A. (2022). A co-integration analysis for the validity of purchasing power parity: Evidence from Middle East countries. *International Journal of Technology, Innovation and Management (IJTIM)*, 2(1), 54-67.

Khan, F. N., & Ahmad, E. (2005). Test of purchasing power parity based on cointegration technique: The Asian evidence. *Pakistan Economic and Social Review*, 167-183.

MacDonald, R. (2007). *Exchange Rate Economics: Theories and Evidence*. Routledge.

Madhavika, W. D. N. (2021). Testing the Validity of Purchasing Power Parity: A Comparison of Sri Lanka and Pakistan. *Empirical Economics Letters*, 20(1), 211-219

Muhammad, S. D., Umer, M., & Lal, I. (2009). Tests of Purchasing Power Parity: Extent of Pakistan. *European Journal of Scientific Research*, 37(4), 608-615.

Nusair, S. A. (2003). Testing the validity of purchasing power parity for Asian countries during the current float. *Journal of Economic Development*, 28(2), 129-147.

Raza, S., Munir, S., & Azam, K. (2022). Does Purchasing Power Parity Hold Between Asian Economies Before and After the Financial Crisis? Evidence from the Time-Series Model. *American Journal of Economics and Business Innovation*, 1(3), 1-7.

Rogoff, K. (1996). The purchasing power parity puzzle. *Journal of Economic Literature*, 34(2), 647-668.

Saeed, A., Awan, R. U., Sial, M. H., & Sher, F. (2012). An econometric analysis of determinants of exchange rate in Pakistan. *International Journal of Business and Social Science*, 3(6), 184-196.

Salema, S. M., & Islam, M. N. (2022). Purchasing Power Parity in Developing-8 Countries: Evidence from Time Series Data. *BUFT Journal of Business & Economics*, 3, 145-158.

Sarno, L., & Taylor, M. P. (2002). Purchasing power parity and the real exchange rate. *IMF staff papers*, 49(1), 65-105.

She, F., Zakaria, M., Khan, M., & Wen, J. (2020). Purchasing Power Parity in Pakistan: Evidence from Fourier Unit Root Tests. *Emerging Markets Finance and Trade*, 57(13), 3835–3854.

She, F., Zakaria, M., Khan, M., & Wen, J. (2021). Purchasing power parity in Pakistan: Evidence from Fourier unit root tests. *Emerging Markets Finance and Trade*, 57(13), 3835-3854.

Sher, F. & Khan, M. Z. (2019). Revisiting Purchasing Power Parity in Pakistan. *Market Forces*, 14(1), 107-118.

Ugur, M. S., & Alper, A. E. (2023). Revisiting Purchasing Power Parity in OECD Countries: New Evidence from Nonlinear Unit Root Test with Structural Breaks. *Sosyoekonomi*, 31(57), 25-45.