CHAPTER - 2
REVIEW OF LITERATURE

2.1 Introduction:

One of the most provocatively debated issues in international macroeconomic literature pertains to whether or not *Purchasing Power Parity* (PPP) holds across borders. The parity condition is the core of many theoretical and empirical models of exchange rate determination. As a matter of fact, the pervasiveness of PPP has gone hand in hand with the literature on the empirical tests of the theory. A plethora of studies has enriched the economic literature on the validity of PPP. Such studies originated in the 16th century and are still continuing in the 21st century. However, the evidences in favour of the PPP are mixed by nature.

The idea of Purchasing Power Parity Theory has been traced to the 16th century. **Salamanca School** of Spain (Officer, 1982). At that time, PPP was an indicator not only of integration of the Spanish and outside economies but also of the importance of monetary influences on exchange rate.

Salamanca invention of PPP theory relates to their empirical observations of the following causal chains:

    i.   Spain received large inflow of gold and silver from the New World.

    ii.   Consequently, the Spanish money stock increased.

    iii.   The Spanish price level also increased.

    iv.   Exchange rates had become unfavourable to Spain.

Thus exchange rate was found to be inversely and proportionately related to the Purchasing Power of currencies concerned. This led to the formation of the crude form the PPP in the 16th century.

The PPP theory, in its modern form, is credited to **Gustav Cassel,** a Swidish economists. He developed and popularized its empirical version in 1920s (Rogoff, 1996). Cassel held that the nominal exchange rate should reflect the purchasing power of one currency against another. He was of the view that a purchasing power exchange rate existed between any two currencies and such purchasing power could be measured by the reciprocal of one country's price level against another. He concluded his theory with the proposition that exchange rate must adjust to ensure that the *'law of one price'* must hold internationally for identical bundle of goods.

2.2   Review of Theoretical Developments:

In the twentieth century economists reconsidered the PPP Doctrine and provided several theoretical platforms for the theory. Some of the important theoretical works are being cited below.

Officer (1984) considers PPP as a flow model since it traces the flow of goods and services through the current accounts in order to determine the exchange rate.

Taylor (1988) holds that free trade is possible between two countries only when equilibrium real exchange rates remain constant over time. In that case nominal exchange rate movements tends to offset relative price movements. This is possible when the nominal exchange rate between currencies of two countries equals the ratio of price levels in the two countries concerned. Thus PPP sets the basis of free trade among countries.

Protopapadakis and Stoll (1986) hold that existence of arbitrage is the driving force behind the PPP. However, commodity arbitrage takes time. Consequently, the theoretical exchange rates and commodity prices in the *'Law of One Price' (LOOP) are forward or future prices and not spot prices.* This means that study on PPP must involve the examination of the relation between exchange rates and the ratio of forward or future prices. They further hold that use of the spot prices instead of forward or future prices would generally lead to the failure of PPP.

Clark, et al (1994) points out that many countries usually undertake collective measures on their exchange rates on the basis of inflation differentials with trading partner countries. While doing so, countries derive the *Fundamental Equilibrium Exchange Rates* (*FEERs*) from the medium term internal and external balance conditions. These *FEERs* are used to detect misalignment in a country's real exchange rate. Consequently, it has become easier to compute PPPs. However, the empirical studies have not yet been taken up to analyse the deviations between *FEERs* and PPPs. Such analysis is expected to provide a better insight about the economic conditions behind the failure of PPP in exchange rate determination.

Foot and Rogoff (1995) and Rogoff (1996) hold that the existence of trade barriers and transformation costs drives a wedge between prices in different countries. As a results, the Law of One Price (*LOOP*) cannot hold exactly.

Rogoff (1996) argues that the wedge depends on the tradability of the goods. For highly traded goods, the wedge becomes thin and for these goods the law (*LOOP*) holds quite well. On the other hand, for traded goods value-added taxes and profit margins widen the wedge resulting in an environment against the law (*LOOP*).

Foot and Rogoff (1995) further hold that, in empirical *tests*, PPP has been tested usually without comparing identical baskets of goods. *Instead,* in these empirical tests *Consumer Price Indices* (CPIs) and *Wholesale Price Indices* (WPIs) are usually used. The use of these indices to test absolute PPP (APPP) invariably leads to results not supporting this version of the theory. This is due to the fact that different countries use different compositions of goods in the baskets for the construction of price indices. *Again,* the weights assigned to goods are not necessarily uniform across countries. APPP measured with this heterogeneous CPIs, are less likely to hold in the empirical studies.

Engel and Rogers (1996, 1998 and 1999) have shown that nominal exchange rate volatility is the major cause of deviations of exchange rates from the PPP level. These volatilities are nothing but short-run variations of exchange rate around its long-run stable

equilibrium level. Consequently, they hold, PPP may be expected to hold good when exchange rates are found to be stable over a considerable period of time.

Jenkins (1995) argues that short-run variations in exchange rates are news-driven phenomena. Announcement about interest rate changes growth rate of GDP in forthcoming periods, and variations in inflation rates etc cause variations in exchange rates in the short-run. However, *such variations* in exchange rates dissipate over years. The time horizon is usually is between 4 and 10 years. When such short-run exchange rate variations wither away, PPP is found to hold good. That's why, empirical studies support the statement that PPP does not determine exchange rate in the short-run.

Bala (1964) and Chinn (2000) give forth several reasons for the deviations of exchange rates from the PPP level. These are as follows:

First, restrictions on trade and capital movements distort the relationship between domestic and foreign prices.

Second, speculative activities and official intervention may create a distortion from the PPP level.

Third, faster productivity growth in the tradable goods sector than that in the non-tradable goods sector, may result in systematic divergence of prices.

Fourth, prices, being usually sticky, do not move rapidly enough to offset frequent changes in nominal exchange rates.

Fifth, non-stationarity of real exchange rate may result in following some real shocks in the economy.

Finally, short-run deviations of exchange rate from the PPP level may arise because of innovations in financial sector, imbalance in government budget, differentials in productivity growth etc in major industrial countries.

Pippenger (2004) questions the conventional idea that the short-run volatility of exchange rate is excessive. The idea is derived from the fact that the variance of monthly changes in exchange rate is much larger than that for monthly changes in relative CPIs. In this connection he points out several problems with these variance ratios.

First, the modern theory of PPP implies such ratios should be larger than one. But more successful the management of monetary policies, the larger will be these variance ratios. As a result, excess volatility will be the largest when flexible exchange rates are working their best.

Second, construction of consumer price indices on the basis of sticky retail prices increases the variance ratios.

Pippenger further argues that the modern theory of PPP suggests that the volatility of exchange rate increased dramatically after the collapse of the Bretton Woods System no doubt. Such rise in volatility was not the effect of the adoption of flexible exchange rate system. But it was because of the fact that pegged exchange rates artificially restricted the movement in exchange rates as compared to the movement that would have been consistent with purchasing power parity.

He concludes by upholding the view that purchasing power parity works at least as well in a stable monetary environment as with hyperinflation. Measurement errors and non-linearities might have caused the misinterpretation of the econometric evidence.

2.3 Review of Empirical Contributions

The empirical studies on PPP may be categorized into three groups on the basis of tests they apply. These are

  i.   the easily '*correlation*' based studies
  ii. the '*Unit Root Test*' based studies where *stationarity* of real exchange rates are examined.
  iii. the '*cointegration*' based studies where *cointegration* between exchange rates and relative price level is being investigated into.

The '*correlation*' based studies were prevalent in the late 1970s and early 1980s. These studies found little support for PPP. The '*Unit Root Tests*' based studies were prevalent in 1980s while the '*Cointegration*' based studies have been taken up since the late 1980s. These studies provided mixed results with respect to the validity of the PPP doctrine in the long-run. Some of the important empirical studies are being cited below.

Frankel (1976) examined the validity of the PPP doctrine in Germany's trade during the hyperinflationary period. His estimated time-series model was

$$S_t = \alpha + \beta P_t + u_t$$

He assumed that foreign price levels were insignificant compared to hyperinflated prices in Germany. So he excluded the foreign price levels from his estimable model. In this estimated equation $\hat{\beta}$ was not statistically different from one. This led him to conclude that RPPP held good for German Deutche Mark during the period of hyperinflation.

Frankel (1981) then tested the validity of PPP with the use of data from the USA, UK, France and Germany during 1970s when these economies were more stable. The estimated β's ranged from below -1 to over 2. Thus in each case the null hypothesis of relative PPP was rejected at least in the short-run.

Johansen and Juselius (1992) are the *fore-runners* in testing combined PPP and UIP with the use of time series data for the UK over the period 1972:1-1987:2. They reject the hypothesis that the PPP relation is stationary by itself. However, they find support for combined occurrence of PPP and UIP. Other studies which provide support for the combination of PPP and UIP into a single relationship include Sjoo (1995), and Pesaran et al (2000).

Wu (1996) tested for unit roots in real exchange rate for 18 OECD countries. He used the pooled data on real exchange rates between the US and the OECD countries for the current float. Standard ADF Tests and Phillips and Perron (PP) Tests were performed on monthly individual real exchange rates. Real exchange rates were found to be non-stationary at conventional significance levels. However, when the panel-based tests were performed, the null hypothesis of unit root was rejected at 1% level. Consequently, the real exchange rates were found to be stationary. This provided the support for the validity of long-run PPP for the post-Bretton Woods Period.

Papell (1997) also used the Panel data analysis to test for long-run PPP. The study was designed for examining the evidence against unit roots in real exchange rate during the current float for industrialized countries.

The estimable equation in his study was

$$\Delta e_{ji} = \mu_j + \alpha \, e_{jt-1} + \sum_{i=1}^{k} C_{ji} \Delta e_{ji-1} + \varepsilon_{ji}$$

The equation was estimated by the *Feasible Generalized Least Squares (FGLS) Method*.

where   e = exchange rate

               j = indices of the countries in the panel.

Monte Carlo methods were used to compute exact finite sample critical values for the test statistics for study. His study found strong evidence against the unit root hypothesis for monthly data but not for quarterly data.

Coakley and Fuertes (1997) also use the *panel unit root test* to analyse real exchange rate data for the G-10 countries and Switzerland. They use monthly data for the period from 1973 to 1996 of bilateral rates, and wholesale as well as consumer prices. They find that in the test involving the use of wholesale price series, the null of a unit root in the real exchange rate is rejected at 5% level. However, the null is rejected at 10% level only when the test is done with the use of consumer price series. Thus they conclude that the real exchange rates in their panel are stationary in all cases. This render support for long-run PPP.

Sarno and Taylor (1998) employ two *multivariate unit root tests* using panel data. Their study provides support for PPP for the post-Bretton Woods Period. They employ the tests on monthly data on bilateral real dollar exchange rates among the G-5 countries for the period 1973 to 1996. From these tests they find evidence of *mean reversion* in all of the real exchange rates examined.

Nagayasu (1998) examines the validity of long-term PPP using data for the 16 African Countries. He uses annual data for the period 1981 to 1994. The study involves the application of a *'Panel Cointegration Technique'* and the *'Panel Unit Roots Test'* to the parallel market exchange rates expressed in US dollars and Consumer Price indices (CPIs). The test for unit root and cointegration in individual countries establishes that PPP is invalid. However, more reliable results are obtained in the panel context, where

the null of non-cointegration is rejected. This confirms the *semi-strong form* of long-run PPP in 16 African countries.

Krichene (1998) studies the relationship between exchange rate and relative price level in five East African countries, namely, Burundi, Kenya, Rwanda, Tanzania and Uganda. Monthly data of bilateral real exchange rates for the period ranging from 1979:1 to 1996:12 have been used in the study.

Bilateral real exchange rates have been found to *revert to* long-run equilibrium. Again the tests for the unit roots in bilateral real exchange rates reject the null hypothesis of unit root. Thus APPP has been supported to be valid in case of Burundi and Kenya, Burundi and Rwanda and Kenya versus Rwanda. This result indicates that arbitrage has been operative among these countries because of the importance of bilateral trade, proximity of markets and rapid transmission of information on prices and profit opportunities.

Krichene further holds that the null hypothesis of unit root, in case of Tanzania and Uganda, cannot be rejected for the entire sample period because of exchange rate misalignments. However the null hypothesis of the unit root stands rejected in the sub-period 1986:1-1996:12.

Mollick (1999) employs the standard unit root test in order to examine the nature of real exchange rate in Brazil over the period 1855-1990. He reports a mixed evidence in favour of *mean reverting* behaviour of the real exchange rates for the period of study.

Islam and Ahmed (1999) test the PPP hypothesis for the bilateral exchange rates and relative price level for Korea and US by employing quarterly data for the period 1971-1996. *Dickey-Fuller* and *Phillips-Perron tests* indicate non-stationary at level for both nominal exchange rates and relative price level. However, both the series are found to be stationary upon first differencing.

They employ both the *Engel-Granger Two-Step Method* and *Johansen-Juselius Method* of cointegration in order to examine the presence of long-run relationship between Korea –US bilateral exchange rate and relative price levels in these countries concerned. The findings lend support for the PPP hypothesis as a long-run equilibrium condition.

However, stronger support was provided by the *Johansen-Jesulius Method* than by the *Engel-Granger Method.*

They find that the estimated value of the coefficient of the relative price variable is lower than unity. So the long-run equilibrium relationship appears to be far from being perfect. The ECM estimates testify for the stability of the relationship that exchange rate maintains with relative price level where the speed of adjustment is about 24% over a year.

The *Granger Causality test* without *error correction* indicates the absence of any causal relation between exchange rate and relative price level. However, the *Granger Causality test* with *error correction* testifies for the *uni-directional causality* running from exchange rate to relative price level. The authors hold that the causality result is not unexpected in view of the fact that the exchange rate in Korea has been under government control for most of the time period covered in this study.

Beharamshah, Haw and Fountas (2002) investigate into the validity of PPP hypothesis for Asia-6 currencies using the *ADRL procedure*. The sample was divided into two sub-periods. One sub-period covers the pre-crisis period and the other relates to the post crisis period.

They report the absence of any cointegrating relationship between the nominal exchange rate and relative price level in the pre-crisis sub-period. However, they find a strong evidence for the *weak form of PPP* in the second sub-period.

These findings imply that the *cointegrating relationship* is time dependent and sensitive to changes in the regime. This implicitly indicates that exchange rates of the East Asian countries were possibly '*overvalued*' during the pre-crisis period. Again, the *mean reverting* behaviour of these currencies over the post-crisis period suggests that departures from the equilibrium or the PPP rates are temporary.

Ahmed and Anoruo, Braha (2002) examine the validity of purchasing power parity doctrine for 11 developing countries, namely, Argentina, Bolivia, Columbia, Cote d'

Ivoire, Equador, Guatemala, Kenya, Nigeria, Peru, South Africa and Venezuela. They specify and estimate the *Dynamic Error Correction Models* for this purpose.

The results from the Unit Root Tests fail to provide evidence of PPP in all of the cases. However, the results from the estimated Error Correction Models present evidence in favour of PPP for 9 countries. So the authors broadly conclude that PPP holds in the long-run.

Schweigert (2002) examines the validity of PPP in the economy of Guatemala with respect to peso/dollar exchange rate. The study period ranges from the late 1890s to mid 1920s. He holds that the behaviour of peso/dollar exchange rate over the period of study is consistent with combined monetary and PPP theories.

In PPP literature the usual hypotheses are that the elasticity of exchange rate

i. with respect to domestic money stock is unity and
ii. with respect to foreign price level is minus one.

The author reports that in his study both the hypotheses cannot be rejected. In the study he finds that exchange rate, domestic money stock and foreign price level series define random walk processes with drift. However, these series are cointegrated at level implying a stationary real exchange rate.

Ogawa and Kawasaki (2003) examine the *non mean reverting* bahaviour of the real exchange rate in six East Asian countries which include South Korea, Thailand, Indonesia, Malaysia, Singapore and Philippines. The base currencies were dollar and yen as the USA and Japan happen to be the most important trading partners of Asia 6-countries. They use the pre-crisis period (January, 1976-June, 1997) data to investigate into the *Generalized PPP (G-PPP) hypothesis* developed by Enders (1994). The *G-PPP hypothesises* real exchange rate will share common trends if fundamental variables are sufficiently interrelated. They report the absence of evidence for PPP for these countries over this period of study.

Lopez and Papell (2003) examine the impact on the Euro on the PPP hypothesis in the context of trade among the constituent countries of Europe. They also consider the trade

between Europe and other Non-Europe countries in this context. They report that the evidence for PPP is clearly stronger within the Euro Zone than between the Euro Zone and other countries.

They further report that the evidence of PPP is stronger for the larger countries in Euro-Zone. These countries are France, Germany and Italy.

Wickremassinghe (2004) examine the empirical validity of the PPP hypothesis in Sri Lanka using exchange rates for six foreign currencies. He observes that real exchange rates derived through CPI and WPI with different base currencies are not stationary. These results are not consistent with the PPP hypothesis.

Again estimation results of the *error correction models* reveal that exchange rates have different adjustment patterns for positive and negative gaps from the long-run PPP relationship. However, domestic and foreign price levels do not show any statistically significant adjustment towards positive and negative gaps from the long-run PPP relationship.

Sedaris (2005) tests for the validity of long-run Purchasing Power Parity (PPP) for seventeen European economics. These countries are Estonia, Latvia, Bulgaria, Croatia, Czech Republic, Hungary, Macedonia, Romania, Slovakia Republic, Slovenia, Georgia, Moldova, Russia, Ukraine and Belarus. Long-run Purchasing Power Parity is initially tested for each economy vis-à-vis the US. Johansen Cointegration Technique and Panel Cointegration Technique have been used for examining the long-run relation between respective bilateral (dollar based) exchange rates and the corresponding relative price level. The analysis provides support for long-run equilibria. However, the coefficients of the estimated cointegrating vectors violate the symmetry and proportionality hypothesizes suggested by Purchasing Power Parity.