

## THE PURCHASING POWER PARITY (PPP) MEASURE OF NAIRA'S EQUILIBRIUM EXCHANGE RATE

By  
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*This paper examined the relevance of the Purchasing Power Parity (PPP) concept in exchange rate analysis using Nigerian data. In this direction, the paper attempted to explore the relationship between the nominal exchange rate and relative prices to establish whether a long run relationship exists between them, and to determine whether the exchange rate is at a competitive level. More importantly, the paper examined the relationship between the series applied in the Study to establish their order of integration. This was done to confirm the utility of applying the cointegration methodology in estimating the model applied in the Study. Whereas, the official exchange rate as a dependent variable showed poor results on the relevance of the PPP for Nigeria, the results were better and PPP was indeed confirmed when the parallel market exchange rate was applied as the dependent variable. The paper observed that monetary and fiscal policies, in addition to supply increasing policies should be applied continuously to ensure that Nigeria remains competitive in the international market. Furthermore, the exchange rate should continue to be market-driven with the PPP as the target. The paper concluded that the exchange rate at the AFEM before its appreciation in the later part of 1997 was within the long-run equilibrium level, and as such should have not been tampered with to prevent demand pressures from exacerbating.*

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### I. INTRODUCTION

The exchange rate can be defined in different contexts, but the underlying element is that it is the price of one currency in terms of another. Thus, it measures the worth of a domestic economy in terms of another, especially in relation to trading partners' economies. There are various measures of the exchange rate, derived from the elasticity, portfolio balance and monetary approaches to exchange rate

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determination. The Purchasing Power Parity (PPP) concept of exchange rate determination is a variant and in fact a component of the monetary approach. The PPP is based on the law of one price which holds that prices of the same commodities would equalize across national borders with differences accounted for by transport costs and information asymmetry. In other words, when perfect information is available, prices should be equal for the same types of commodities. When price differentials are maintained for a long period of time, the exchange rate becomes misaligned with dire consequences for domestic economic stability and external sector viability. Thus, with the PPP, exchange rate misalignment is seen as a fallout from movements in relative prices between trading partners.

An equilibrium exchange rate is achieved when a given level of exchange rate enables an economy to achieve the twin objectives of internal and external balance without the imposition of trade and exchange controls and actions that may be at variance with international norms and, therefore, amount to arbitrariness. Such actions usually precipitate retaliatory responses that further undermine the goals of macroeconomic management. Internal balance is achieved when a non-inflationary rate of economic growth is achieved (low inflation, and high and sustainable rate of economic growth), while external balance assumes the attainment of a realistic exchange rate that promotes external sector competitiveness and balance of payments viability. The exchange rate is an important element in an adjustment programme since it is a relative price that affects other prices, thus leading to resource re-allocation in the real sector and portfolio shifts in the financial sector. These actions directly and indirectly contribute to the achievement of macroeconomic stabilization, growth and external sector competitiveness and viability.

Nigeria has applied the exchange rate as a crucial element of its adjustment efforts since 1986 when the domestic currency was floated in the Second-tier Foreign Exchange Market (SFEM). Initial gains in the form of increased non-oil export receipts soon filtered away with the reflation of the economy in 1988. Various methods have been applied since then to stabilize the exchange rate and

evolve a realistic exchange rate mechanism. The exchange rate and foreign exchange reforms undertaken since 1995, which resulted in the introduction of the Autonomous Market for Foreign Exchange (AFEM) for direct foreign exchange allocation to end-users have proved helpful. The exchange rate has been stabilized and the economy has resumed growth. However, the current exchange rate is assumed to have diverged somewhat from the long-run equilibrium level.

The problem confronting exchange rate management at the moment is the inability to determine precisely the level of the exchange rate of the naira, that would ensure the attainment of internal and external balance simultaneously on a sustainable basis. The objective of the study is, therefore, to find out whether a long-run relationship exists between the nominal exchange rate and relative prices. If a long-run relationship is established then the PPP holds, otherwise the PPP would not be a perfect guide for short-run exchange rate analysis.

The Study covers the period 1970 through 1996, and secondary data form the basis of analysis. The Study is important because it would provide an insight into the relevance of the PPP in exchange rate determination and analysis on the basis of Nigerian data. Various studies that have been carried out have provided only partial indication of the relevance of the PPP in the Nigerian context.

The methodology applied in the Study involves the use of annual data series and the application of relevant econometric techniques to arrive at the model that best fits the data. The Ordinary Least Squares (OLS) estimation method is applied primarily.

The rest of the paper is organized into four parts. The theoretical framework and review of relevant literature are contained in part II, while part III is devoted to model specification. Data analysis, model estimation and interpretation of results are treated in part IV and part V concludes the paper with summary, conclusions and recommendations.

## II. THEORETICAL FRAMEWORK AND REVIEW OF RELEVANT LITERATURE

The equilibrium exchange rate is the desired level of the rate that ensures the simultaneous attainment of internal and external balance. Internal balance reflects a low inflationary rate of economic growth while, external balance involves external sector viability and competitiveness on account of adequate accommodating capital flows to finance imbalances in the current account. Thus, the achievement of a high and sustainable rate of domestic economic growth in addition to price stability and external sector competitiveness amount to the attainment of internal and external balance. The exchange rate at which this is attained is the equilibrium exchange rate.

There are two main approaches to determining the equilibrium exchange rate. The simplest and most popular approach is based on the notion of relative Purchasing Power Parity (PPP), the central tenet of which is that the equilibrium exchange rate is proportional to the relevant relative purchasing power of the national currencies involved (Aghevli et al, 1991:8). The competing approach, and theoretically more appealing, defines the equilibrium exchange rate in terms of the relative price of tradeables to non-tradeable. This approach, also referred to as the Salter-Swan model, assumes that the non-tradeable sector is neutral to exports and competing imports (Davaranjan et al, 1993:46). This approach attempts to situate the equilibrium exchange rate within the context of real economic fundamentals. The tradeable/non-tradeable concept of the equilibrium exchange rate is also referred to as the Real Exchange Rate (RER).

The PPP is predicated on the law of one price which holds that identical goods should cost the same in all countries, assuming transportation costs are eliminated and trade tariffs and quota restrictions are removed (Hakkio, 1992:38). The law of one price ensures that the same commodities or a basket of commodities attract the same price across national boundaries. In order to take advantage of differences in prices of the same set of commodities, funds' move from the costly centres to the cheap centres to assert command over the cheaper commodities.

As the process goes on, the profit margin becomes narrower and prices eventually equalize across countries. In real life, it is not possible to achieve this type of self-sustaining price equalization owing to a number of restrictions imposed on trade and payments by various countries. Nevertheless, it remains a valid theoretical basis for analysing the PPP and trade flows among countries. The PPP is defined in both its absolute and relative versions. The absolute PPP is a bilateral comparative index of overall price levels, while the relative PPP captures inflation differentials. While the absolute PPP ignores the historical level of the exchange rate, the relative PPP adopts a base period exchange rate when the economy is assumed to be in equilibrium for the purpose of arriving at the equilibrium exchange rate on the basis of current price movements. The PPP in its absolute version can be represented by  $P_d/P_f$  where  $P_d$  is domestic price level and  $P_f$  is foreign price level (usually measured by the wholesale price index). In its relative version, the PPP can be formulated as follows:

$$E_0 P_d/P_f \dots\dots\dots (1)$$

where  $E_0$  is the base period exchange rate,  $P_d$  and  $P_f$  are inflation rates for the domestic economy and trading partners' economies, respectively. Where the exchange rate is quoted in units of foreign currency, the relative prices are expressed in the reversed order ( $P_f/P_d$ ), Obaseki et al (1996:404). The extent of deviation of the actual exchange rate from the PPP can be measured through the formula

$$\bar{E}_t = E_t/PPP \dots\dots\dots (2)$$

substituting 1 into 2 yields the valuation index for establishing the extent of over-or under-valuation of the nominal exchange rate. The following formula ensues,

$$\bar{E}_t = E_t \frac{P_f}{E_0 P_d} \dots\dots\dots (3)$$

This is the same as equation 2 but expressed differently. Equation 3 is simply the product of the current exchange rate and the inverse of the relative PPP. When  $\bar{E}_t > 1$ , undervaluation is indicated. The reverse depicts overvaluation.

The equilibrium Real Exchange Rate (RER) in the Salter – Swan model is expressed as follows:

$$E_p/P_n \dots\dots\dots (4)$$

where E is the nominal exchange rate,

$P_t$  is the world price of tradeables and

$P_n$  is the domestic price of non-tradeables.

The equilibrium real exchange rate is assumed to reflect changes in real variables only, while the actual real exchange rate is a function of real and monetary variables. The extent of misalignment of the exchange rate is reflected by the divergence of the actual real exchange rate from the equilibrium level.

The real exchange rate is not an immutable constant. It changes on the strength of movements in the intermediate determinants of the equilibrium real exchange rate, otherwise referred to as real exchange rate fundamentals. The external fundamentals include international prices, international transfers and world real interest rates, while the domestic fundamentals, which are policy-related, include import tariffs, exchange and capital controls and taxes (Edwards, 1992:48). Although the real exchange rate measure of the tradeables/non-tradeables school has been criticized for failing to provide a conclusive basis for distinguishing tradeables from non-tradeable goods, the proponents of the school have written off the PPP approach on the basis that it sees all deviations from the PPP as a disequilibrium. Changes in the equilibrium real exchange rate are held to reflect in some cases, equilibrium conditions generated by changes in fundamentals (Edwards, 1992:49). Thus, the equilibrium real exchange rate may not be a given number. Rather than a strong criticism of the PPP, the point on immutability of the real exchange rate is in accord with the main tenet of the PPP. This explains why the base period is constantly reviewed to align with the fundamental developments in the economy. Although non-monetary factors may be relevant in determining the equilibrium real exchange rate, to the extent that such other factors like price and interest rate expectations, technological changes, trade and exchange restrictions are reflected in relative price movements, the PPP

becomes the most crucial and dominant factor in exchange rate analysis in the long run.

A stronger criticism of the PPP is the choice of a base year and the continued relevance of the base year in view of changing economic circumstances. As a result of changes in the external environment and the structure of an economy, the current account may not always be in equilibrium. As a result, the real exchange rate for the benchmark year will not be an equilibrium value in the post shock period (Davaranjan et al 1993:46). This problem can be resolved through constant monitoring of economic fundamentals to determine when to revise the base period. Although the PPP is a long run equilibrium approach, it remains useful for short-run exchange rate management since it indicates the path towards the equilibrium exchange rate. However, a lot of controversies have trailed the effectiveness of the PPP in the short and long-run. Beng et al (1993:4) observed that the basis for calculating the deviation of the actual exchange rate from the PPP is contingent on the assumption that the actual real exchange rate would converge to its base period value in the long run. Their conclusion was that there is no systematic tendency for exchange rates to revert to their long run PPP values. Their preferred approach, the Fundamental Equilibrium Exchange Rate (FEER) is an adaptation of the PPP. Instead of applying a base period exchange rate, the nominal or current exchange rate was used. The FEER is a product of structural capital flows, long term growth trend of the economy and long run trade elasticities, Beng et al (1993:5). As a result, it is closely related to the Salter-Swan equilibrium real exchange rate based on the analysis of the prices of tradeables and non-tradeables. The difference is that the fundamental elements, which could induce shifts in the equilibrium exchange rate, are captured under the FEER.

Baharumshah et al (1994:3) suggested in their study that the short-run PPP has been rejected by numerous studies, citing in particular Frenkel's 1981 work on the collapse of the PPP in the 1970s. They therefore, concentrated on testing the long-run relevance of the absolute PPP. Dueker (1993:39) noted that a lack of

consensus emerges from empirical tests of long-run PPP, owing in part to the choice of the null hypothesis. Hakkio (1992:40) showed that the PPP holds in the long run as deviations of the exchange rate from the PPP generally result in movements back towards the PPP over a long period of time. The flexible monetary model of exchange rate determination (Frenkel, 1976; Bilson, 1978) assumes that the PPP is relevant both in the short and long-run. On the other hand, the sticky monetary model alludes to the relevance of the PPP only in the long-run as sticky prices in the short-run prevent the PPP from holding. Pippenger (1993) established long-run PPP relationship between Switzerland and various countries. It appears, therefore, that overwhelming evidence exists to fault the efficacy of the PPP in the short run, while its long-run relevance remains somewhat contentious but proven in isolated circumstances. While the theoretical exposition remains valid, its practical usefulness, especially in the long-run has not been conclusively determined. However, it remains useful for thinking about long-run tendencies in exchange rates (Neely; 1994:26). The fact that its long-run usefulness has been established for some countries encouraged us in this study to test the long-run relevance of the PPP with Nigerian data.

The conventional approach for testing for the validity of the PPP in the long-run consists of testing for a unit root in the real exchange rate, (Dueker, 1993:4). The procedure involves the establishment of the status of the series to be employed in the analysis and estimation, whether they are stationary or not, and if they are, the order of integration. If adequate care is not taken to determine the status of the series, spurious regression may result in inconclusive or misleading results arising from different order of integration of the series. To establish long-run relationship, stationarity must be confirmed. If the series are not stationary, long-run relationships would not exist. Stationarity means that the series have turning points or that they are mean reverting, and that after some disturbances, they return to a defined path. The concept of cointegration (Branger 1981, 1986, Hendry 1986, Hall 1986, Mills 1990) establishes the link between integrated processes and the concept of steady

state equilibrium. Cointegration theory assumes that even when two series are not themselves stationary, there may exist some linear combinations of the series that may be stationary. Furthermore, cointegration technique arose from the need to integrate short-run dynamics with long-run equilibrium through the inclusion of an error correction mechanism in the dynamic formulation of the model for estimation. Eken et al (1995:27) indicated in their study that similarly integrated series will have linear combinations that will converge to stationary long-run equilibrium relationships. They advanced further that stationarity, the prelude to cointegration can be achieved through differencing of data, or formulating a regression model with non-stationary variables, a linear combination of which produces stationary error terms.

The most important aspect of cointegration analysis is the presence of a stationary error or disturbance term. To minimize the incidence of spurious regression, it is necessary to ascertain that the time series for analysis and estimation are of the same data-generating process or of the same order of integration. This is because series of different order cannot cointegrate or move together. Once the order of integration has been established and the error term is stationary even when the series are not, it follows that linear combinations of the series that are stationary exist. Thus, the variables in the series have the tendency to move together. Exogenous disturbances will in the long run fizzle away and an equilibrium will be re-established. Baharumshah, et al (1994:2) further reinforced the importance of the cointegration technique as, its exploit of the non-stationary properties of economic variables, the non-reliance on the assumptions of exogeneity or causality among variables and its provision of an ideal framework for testing long-run equilibrium relationships implied by economic theory without imposing any constraint on the short-run dynamics. Thus, the cointegration technique does not lead to the invalidation of results owing to simultaneous equation bias, while the long-run properties of the series being estimated are preserved through the inclusion of an error correction term in the model.

### **III. RESEARCH METHODOLOGY**

This section addressed issues relating to data sources, research methods, model definition and specification.

#### **III.1 Sources of Data**

Secondary data are applied in the determination of the relationship among the variables. The availability of robust data on exchange rates and relative prices made the process of estimation reasonably comfortable. Although it would have been important to compare the results of low frequency data with those obtained from high frequency data, the Study relied on low frequency data since these were the data readily available. This procedure is, however, convenient since earlier studies applying high frequency data could not confirm the validity of long-run PPP. Estimations with low frequency data have in some cases produced results confirming that the PPP holds in the long-run. Bahmani-Oskooee (1993:1029) observed that Taylor, Carbae and Ouliaris' monthly bilateral exchange rates and the cointegration technique test of the PPP for the US dollar failed to confirm that the PPP holds in the long-run. However, when annual data were applied by Edison (1987) and Kim (1990), empirical evidence supporting the PPP for the US dollar was obtained. The data series applied in model estimation covered the period 1970 through 1996. The data were obtained from publications by the Central Bank of Nigeria (CBN), the Federal Office of Statistics (FOS) and the International Financial Statistics of the IMF.

#### **III.2 Research Methods**

The Ordinary Least Squares (OLS) estimation method was used to analyze the data. The cointegration technique was also applied in the estimation and analysis of the data. The data were tested for stationarity and cointegration. This was meant to establish whether the PPP holds in the long-run or not. The Study proceeded to estimate the PPP model to establish the impact of the various

explanatory variables on the dependent variable. The OLS for the static model was estimated and compared with the results from the dynamised model through differencing and use of lags up to the permissible limit of four. An error correction mechanism was included in the dynamic formulation of the model to preserve both the short-run and long-run relationships implied in the theoretical formulation of the model. Since differencing would have resulted in the loss of some vital information, the error correction mechanism was applied to minimise the loss of information. This formulation is to that extent superior to a partial adjustment model. The econometric package, Microfit was applied in the estimation.

### III.3 Model Specification

Most of the studies on the long-run relevance of the PPP have applied the absolute PPP version, regressing the nominal exchange rate on relative prices. Bahmani-Oskooee (1993:1024) and Baharumshah (1994:4) adopted the absolute PPP version in their analysis. However, Bahmani-Oskooee applied a geometric weighted average instead of nominal exchange rates. Both studies started by relating the exchange rate to relative prices,

$$E_t = P_d/P_f \quad \dots\dots\dots (1)$$

where  $E_t$  is the nominal exchange rate and  $P_d$  and  $P_f$  are as defined earlier.

Representing  $P_d/P_f$  with  $P_r$ , relative prices, equation (1) can be written as

$$E_t = P_r \quad \dots\dots\dots (2)$$

The log transformation of (2) in addition to the assumption of an intercept and slope coefficient yields,

$$\log E_t = \alpha_0 + \alpha_1 \log P_r + \Sigma_t \quad \dots\dots\dots (3)$$

where  $\Sigma_t$  is the disturbance term or the reflection of the deviation of the observed exchange rate from the long run equilibrium PPP value.

The a priori expectations are that  $\Sigma_t$  should be a stationary process in order to ensure that deviations from its equilibrium or mean value are corrected overtime.

Equation (3) can be written in the form,

$$\log E_t = \alpha_0 + \alpha_1 \log P_d + \alpha_2 \log P_f + \Sigma_t \quad \dots\dots\dots (4)$$

Equation (4) can be estimated with or without the proportionality and symmetry assumptions regarding the long-run PPP. Were the restrictions to be imposed,  $\alpha_0$  would be expected to be zero,  $\alpha_1$  and  $\alpha_2$  would be equal to one respectively, meaning that  $\alpha_1 = \alpha_2$ . The basis of equation 3 and 4 is the assumption of perfect commodity arbitrage in the long-run and the fact that monetary disturbances do not alter the long-run path of exchange rates, necessitating a mean reverting tendency. Equation 4 is basically the representation of the long-run PPP. Instead of  $E_0$ , the base period exchange rate,  $\alpha_0$  can be substituted in equation 4. This is because  $\alpha_0$  and  $E_0$  are assumed to be equal for PPP to hold. Equation 4 has been estimated to test the long-run relevance of the PPP on the basis of Nigerian data.

The Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests were applied on the strength of the Null Hypothesis that the error term is non-stationary  $I(1)$  against the alternative that it is stationary  $I(0)$ . Conversely, the test was carried out to ascertain the Null Hypothesis of the absence of cointegration against the alternative hypothesis of cointegration. The Autogressive Error Correction estimation technique was also applied to improve the results of the model.

#### **IV. DATA ANALYSIS, MODEL ESTIMATION AND INTERPRETATION OF RESULTS**

##### **IV.1 Data Analysis**

In order to determine whether long-run relationship exists among the variables, the series were tested for stationarity. This test is important not only to determine the order of integration of the series but also to verify if cointegration techniques can be applied in estimating the model.

Stationarity and cointegration are crucial in exchange rate analysis, especially the PPP measure of exchange rate to determine if the variables involved are mean-reverting and whether long-run relationship exists between them. If the variables are not stationary and do not exhibit long-run relationship, the policy relevance of the

model incorporating the variables would be suspect, especially for medium to long-term policy design.

The cointegration technique was applied to determine possible long-run relationship between the exchange rate and relative prices. The unit root tests on the variables showed that they were differenced stationary of order 1. Thus, after first differencing they became stationary. Both the DF and ADF tests confirmed the integrating process exhibited by the data. Although the series are not  $I(0)$  or stationary in their levels, their residuals were confirmed to be stationary. Thus, a long-run relationship exists between the variables. This encouraged us to apply the cointegration technique. The unit root test of variables to establish order of integration came out as follows:

#### UNIT ROOT TEST OF VARIABLES\*

	<b>Without trend</b>	<b>With trend</b>
DLST	DF -5.4411(-2.9850) ADF -3.1972(-2.9907)	-6.7013(-3.6027) -4.6944(-3.6119)
DLCPI	DF -6.0117(-2.9850) ADF -4.4455(-2.9907)	-6.4925(-3.6027) -7.2302(-3.6119)
DLCPIUS	DF -7.0174(-2.9850) ADF -3.8943(-2.9907)	-7.3116(-3.6027) -4.6606(-3.6119)
PMP	DF -3.5987(-2.9798) ADF -3.0049(-2.9850)	-4.2025(-3.5943) -4.0072(-3.6027)
DLPST	DF -4.4229(-2.9907) ADF -2.8911(-2.9970)	-5.6349(-3.6119) -4.4161(-3.6219)

where

DLST is the first difference of the spot (official) exchange rate.

DLCPI is the first difference of domestic consumer price index.

- \* 95% critical values in brackets. Stationary series should be largely negative and greater in absolute terms than the critical values, except in borderline cases

DLCPIUS is the first difference of the trading partner (US) consumer price index.

PMP is the parallel market premium in its level.

DLPST is the first difference of the parallel market exchange rate.

#### IV.2 Model Estimation and Interpretation of Results

Two models with the same explanatory variables were estimated. The first model had the official nominal exchange rate as the dependent variable, while the second model applied the parallel market exchange rate as the dependent variable. The explanatory variables in both cases were the domestic consumer price index and the United States\*\* consumer price index.

The first model did not perform well as expected since the official exchange rate is fixed or at best administered for most of the period. When the long-run static model was run, a priori expectation regarding the signs of the explanatory variables was met. The residuals were stationary as established through the OLS methodology. The error correction model intended to preserve the long-run properties of the model after differencing showed that none of the explanatory variables was statistically significant, although domestic consumer price index, DLCPI performed relatively better at a t-ratio of 1.5. Although the Durbin Watson (DW) statistic was good at 1.92 and the explanatory variables had correct signs, both the  $R^2$  and  $R^{-2}$ , reflecting the explanatory power of the variables, were low at 0.26 and 0.16, respectively. The over-parameterised model did not perform better. The step-wise regression procedure attempted also failed to provide better results.

In order to get improved results, the second model applied the parallel market exchange rate as the dependent variable. The estimation of the long-run static model confirmed a priori expectation on the signs of the explanatory variables. The residuals were also confirmed to be stationary. The error correction model showed a relatively low DW statistic of 1.6 and low  $R^2$  and  $R^{-2}$  of 0.26 and 0.15,

\*\* The United States is a major trading partner of Nigeria (purchases about 50% of crude oil exported by Nigeria).

respectively. The foreign consumer price index was more significant than the domestic price index. This result shows that developments in foreign prices, especially in trading partners' economies are relevant for movement in the exchange rate in the domestic economy. The model was over-parameterised with 4 lags for the explanatory variables in order to improve the results. The subsequent step-wise regression to refine the model for better results yielded various outcomes, but the best showed a DW statistic of 1.95. The domestic price index (DLCPI) and the foreign price index (DLCPIUS) had correct signs, while the latter was statistically significant at -2.1. The first and second lags of the foreign price index showed t-ratios of -1.7 and -1.3, respectively. These were much higher than the 0.7 recorded for domestic price index at the fourth lag, DLCPI(-4). This shows that while the exchange rate responds to past developments in domestic prices, recent developments in foreign prices and past developments are important for exchange rates movement in Nigeria. However, recent developments in foreign prices are more important than past developments. The final step-wise regression also showed improved performance of the variables in terms of the  $R^2$  and  $R^{-2}$ . Although the explanatory power of the variables is low, they nonetheless impact directly on the movement in the exchange rate. They are, therefore, important in determining the direction of movement in the exchange rate and policy options that could reverse such movements when intended.

In the drive to further improve the results, an autoregressive error specification methodology was applied. The two independent variables were statistically significant with correct signs. The  $R^2$  and  $R^{-2}$  were comfortable at 0.95 and 0.92, respectively, while the DW statistic of 2.1 was a remarkable improvement over the cointegration model estimation. Thus, both domestic and foreign prices influence movement in the domestic exchange rate. Shown below are selected regression results from the estimation of the cointegration and autoregression error correction models with the parallel market premium as the dependent variable.

**SELECTED REGRESSION RESULTS**

	Dependent Variable	Independent Variables	R <sup>2</sup>	R <sup>-2</sup>	SER	DW
LONG-RUN STATIC MODEL	LPST	1.8 + 1.2LCPI - 1.2LCPIUS (1.1) (8.8) (-2.4)	0.89	0.88	0.51	1.5
ERROR CORRECTION MODEL	DLPST	0.2 + 0.2DLCPI - 1.4DLCPIUS - 0.4RECM(-1) (1.6) (0.7) (-1.2) (-1-5)	0.26	0.15	0.41	1.6
STEP-WISE REGRESSION	DLPST	0.6 + 0.2DLCPI (-4) - 2.8DLCPIUS (2.9) (0.7) (-1.2)				
		-2.3DLCPIUS(-1) - 1.4DLCPIUS(-2) (-1.7) (-1.3)				
		-0.4DLCPIUS(-4) - 0.1RECM(-1) (0.4) (-0.6)	0.46	0.25	0.40	1.95
AUTOREGRESSIVE ERROR SPECIFICATION	LPST	7.7 + 1.6LCPI - 2.9LCPIUS (3.5) (10.6) (-4.7)	0.95	0.92	0.45	2.1

## **V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

### **V.1 Summary**

A major aim of macroeconomic management is to achieve internal and external balance, without the imposition of controls, through an equilibrium or realistic exchange rate. The Purchasing Power Parity (PPP) is one approach for determining the equilibrium exchange rate. Although it is a long-run equilibrium concept, it is useful for short-run policy analysis. The PPP is based on the law of one price which holds that identical goods should attract the same prices in all countries if information asymmetry is assumed to be absent. Although the usefulness of the PPP as a long-run equilibrium approach to exchange rate determination has been questioned by some economists, the theoretical underpinnings of the concept and the fact that its efficacy has been established for some countries makes it somewhat valid as a tool of exchange rate management. The main thrust of the PPP is that the exchange rate is influenced by developments in relative prices. These are movement in domestic prices relative to those of major trading partners. The PPP in its relative version is the product of the base period exchange rate and relative prices. The problem confronting exchange rate management in Nigeria is how to evolve an appropriate exchange rate mechanism that would ensure the simultaneous attainment of internal and external balance, in addition to an exchange rate level that does not drift very far away from the long-run equilibrium level.

### **V.2 Conclusions**

The main conclusion of the paper is that a long-run equilibrium relationship exists between exchange rates and relative prices on the basis of Nigerian data. This was established through the unit root tests which showed that the series applied in the study are differenced stationary while the residuals are trend stationary. Thus, the long-run PPP holds on the basis of the data applied in the study. The PPP does not appear to be valid for Nigeria when the official exchange rate was applied as the dependent variable. However, the validity of the PPP for Nigeria was established when the parallel market exchange rate was substituted as the dependent variable.

The reason for this is that when exchange rates are fixed or administered, their levels are not influenced by developments affecting prices in the domestic economy and in trading partners' economies. The PPP is more relevant as a measure of the realistic exchange rate when a market based system is operated by the trading economies. The policy implication is that when prices increase more in an economy relative to the trading partners' economy, the exchange rate in the former would tend to be overvalued, especially when deliberately maintained at that level through controls.

### V.3 **Recommendations**

Monetary and fiscal policies should be applied continuously in addition to supply increasing measures to ensure that price level increases are not excessive vis-a-vis our major trading partners. This is necessary to make the economy competitive and reduce pressure on the exchange rate.

The exchange rate should continue to be market-driven with an indicative band based on the PPP, outside which the Central Bank would intervene to keep the exchange rate on the long-run equilibrium path.

Since the long-run PPP has been established on the basis of data applied in the study, the PPP exchange rate can be computed as a guide to the level at which the exchange rate can be said to be realistic. An analysis of Nigeria and US consumer price indices between 1991 and 1997 showed that the naira was undervalued between 1993 and 1995 but overvalued since 1996. The trend is shown in the data presented below with 1992 as the base year.

YEAR	CONSUMER PRICE INDEX		PPP	NER
	NIGERIA	USA		
1991	69.2	97.1	12.1	9.9
1992	100.0	100.0	17.0	17.0
1993	157.2	107.2	24.9	22.0
1994	246.8	109.3	38.4	22.0
1995	426.7	110.0	65.9	70.4
1996	553.9	112.0	84.1	69.8
1997	591.0	113.0	88.9	82.0

At the end of 1997, the nominal exchange rate (NER) averaged ₦82.0 = \$1.00 at the Autonomous Foreign Exchange Market, while the calculated PPP rate stood at ₦88.9 = \$1.00. Although this showed an over-valuation of the nominal exchange rate, it did not indicate instability that should elicit policy actions since the range was still narrow at 8.4 per cent and unlikely to result in payments instability. Furthermore, the PPP measure indicates the direction the nominal exchange rate should move over a period of time to achieve the long-run equilibrium rate. An automatic adjustment is, therefore, unwarranted. If the average nominal exchange rate of ₦82.0 = \$1.00 was maintained for the whole of 1997, the demand pressures that exacerbated in the AFEM in first two months of 1998, following the appreciation of the naira in the latter months of 1997, should have been avoided. Exchange rate policy should target the range of ₦82.0 to ₦88.9 = \$1.00 in the short-term and a range of 5 per cent (₦84.5 to ₦88.9 = \$1.00) in the medium term.

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