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Does the Theory of Uncovered Interest Parity Hold for Nigeria?

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ABSTRACT
This study employs the conventional Uncovered Interest Parity (UIP) equation to test the validity of the theory for Nigeria vis-à-vis the United States of America. The study also examine the causality relationship existing between the variables in the UIP model. The results reveal the invalidity of the UIP theory for Nigerian Naira/ United States dollar exchange rates. We hereby conclude that the existence of abnormal profits from interest arbitrage means that the Uncovered Interest Parity between Nigeria and the U.S.A did not hold in reality at some points in time within the period under review. However, the reasons for the failure of UIP theory for Nigeria might be that the capital mobility between the countries is not perfect, or the risk premium in Nigeria is high as perceived by the potential investors. Country risk, which includes political risk and economic risk remain higher for developing countries including Nigeria, than for the developed countries.
JEL Classification: E4, E42, E43, F3, F31
Key Words: Uncovered Interest Parity, international finance, foreign exchange market, Interest rate Differential

1.0 INTRODUCTION

Studies on the puzzle of uncovered interest parity (UIP) is enormous in the literature. And as suggested by Moore and Roche (2011), there is a multitude of relatively recent theoretical papers which explain the failure and success of uncovered interest parity. There are behavioural explanations (Gourinchas and Tornell, 2004; Fisher, 2006; Burnside, et al 2009); rational inattention is offered by Bacchetta and Van (2010); institutional features are emphasised by Carlson and Osler (2005); and Alvarez, et al (2009) explain the forward bias by permitting a time varying degree of asset market participation.

Fundamentally, foreign exchange trading gave rise to the notion of covered interest parity (CIP) which related the differential between domestic and foreign interest rates to the percentage difference between forward and spot exchange rates. This was a short step to the assumption of UIP since UIP builds on the theory of CIP by postulating that forward exchange rate are driven into equality with the expected future spot exchange rate by market forces, (Isard, 1991; Moore and Roche 2011). .

Uncovered Interest Parity (UIP) is one of the fundamental theoretical building blocks for understanding the behavior of returns in international financial markets. More specifically, it is a crucial element of monetary models of exchange rates. UIP provides a simple relationship between the interest rate on an asset denominated in any one country's currency unit, the interest rate on a similar asset denominated in another country's currency, and the expected rate of change in the spot exchange rate between the two currencies (Isard, 1991). It postulates that market forces drive the expected rate of change in the spot exchange rate between two currencies into equality with the difference between the interest rates on comparable assets denominated in the two currencies. If UIP holds, the return on a domestic currency deposit equals the expected return from converting the domestic currency into foreign currency, investing it in a foreign deposit and then converting the proceeds back into the domestic currency at the future expected exchange rate. Consequently, expected excess returns in the foreign exchange market then equal zero on average. Therefore it differs from the Covered Interest Parity in that the exchange rate exposure to cross-border investment is not covered by the forward contract, leaving the investor at a risk of future spot exchange rate deviations from expectation.

The Uncovered Interest Parity is recognized as one of the fundamental theories on exchange rate determination. UIP assumption has played a central role in the development of multi periods and continuous time models of open economies. The importance of CIP and UIP lie in the fact that they can be used in measuring capital mobility among countries. In addition to balancing Balance of Payments, improving terms of trade, meeting developmental requirements among others, an important benefit of Long term Capital Movement has to do with equalizing interest rates between countries involved in international capital movement. If there are no

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restrictions in international capital movements, capital moves from capital surplus country to capital scarce country due to the fact that interest rate is higher in the latter. Ultimately, interest rate increases in the capital exporting country and falls in the capital importing country. Thus the verification of UIP in international financial markets would be a joint testing of capital mobility and foreign exchange rate market efficiency.

It has become one of the most debatable issues, to determine whether Uncovered Interest Parity holds between countries, most studies that support the Uncovered Interest Parity like Meredith and Chinn (1998), found evidence that it holds in long run horizons than in short horizons, while other studies like Diez de Los Rios and Sentana (2007), have negated the assumption. Therefore this study aims at finding whether Uncovered Interest Parity holds between Nigeria and the United States of America, with U.S.A being the anchor country.

In addition, the Uncovered Interest Parity assumes equal returns (interest rates) for similar assets, when the interest rates spread between domestic and foreign investments are denominated in the same currency, otherwise interest arbitrage exists. i.e, under perfect capital mobility, capital flows should equalize the returns on any two assets that differ only in their country of issue and currency of denomination. If parity tests where comparable assets are used end up in confirmation of the theory, no barriers thwart capital mobility (Kumhof, 2000). But we find for instance, that the interest rate of Nigeria and that of USA varies over time. In 1970, the interest rate of the former was 4.50% while that of the later was 7.91%. In 2000, Nigeria's interest rate was 13.50% while that of USA was 9.23%. The year 2001 had 14.31% for Nigeria and 6.91% for the US. In 2002, it was, Nigeria: 19.00%, USA: 4.67%. The 2005 case was 13.00% for our country of study and 6.19% for the country we are using as anchor country.

Therefore, the continuous variation in the interest rate of these two countries, especially Nigeria (the study country) raises suspicion of interest rate arbitrage. In an attempt to verify the existence of this arbitrage, thereby nullifying the validity of UIP or otherwise, this research is set to (a) Examine the validity of the Uncovered Interest Parity theory for Nigeria (b) Ascertain the causal relationship existing between the variables in the conventional UIP model used in (a) above. The rest of the paper is structured as follows: Section 2: Literature Review; Section 3: Methodology; Section 4: Result Presentation, Discussions, policy recommendation and Conclusions.

2.0 LITERATURE REVIEW

The Theory of Interest Parity received prominence from expositions by Keynes (Keynes, 1923) whose attention had been captured by the rapid expansion of organized trading in forward exchange following World War 1 (Ernzig, 1962). The Interest Parity relationship states that spreads on yields of two countries should be compensated for by currencies movements so that no excess returns are possible.

Although an understanding of the forward exchange markets must have developed within various banking circles during the second half of the nineteenth century, apart from an isolated exposition by a German economist, Walter Lotz (1889), the nineteenth century literature on foreign exchange theory apparently dealt with spot exchange rates. Einzig (1962). Forward exchange trading gave rise to the notion of covered interest parity which related the differential between domestic and foreign interest rates to the percentage difference between forward and spot exchange rates, and since it was clear that forward rates reflected perceptions about future spot rates, it was a short step to the assumption of UIP since UIP builds on the theory of CIP by postulating that forward exchange rate are driven into equality with the expected future spot exchange rate by market forces. (Isard, 1991).

The concept of Interest Parity recognizes that portfolio investors at any time t, have the choice of holding assets denominated in domestic currency, offering their own rate of interest r_d,t between times t and t+1, or assets denominated in foreign currency, offering their own rate of interest r_f, t. thus an investor starting with one unit of domestic currency should compare the option of accumulating $1+r_d$,t units with the option of converting at the spot exchange rate into s_t units of foreign currency, investing in foreign assets to accumulate s_t $(1+ r_f, t)$ units of foreign currency at time t+1, and then reconverting into domestic currency. If the domestic and foreign differ only in their currencies of denomination, and if investors have the opportunity to cover against exchange rate uncertainty by arranging at time t to reconvert from foreign to domestic currency one period later at the forward exchange rate f_t (in units of foreign currency) then market equilibrium requires the condition of CIP:

$$1+ r_d, t = s_t (1+r_f, t) / f_t$$

If the above condition does not hold, profitable market opportunities could be exploited without incurring any risks. Investors also have the opportunity to leave their foreign currency positions uncovered at time t and to wait until time t+1 to make arrangements to reconvert into domestic currency at the spot exchange rate s_{t+1}. unlike f_t, the value of s_{t+1} is unknown at time t, so that the attractiveness of holding an uncovered position must be assessed in terms of the probabilities of different outcomes for s_{t+1}.The assumption of UIP postulates that market forces will equilibrate the return on the domestic currency asset with the expected value at time t of the

yield on an uncovered position in foreign currency (Et).

$$1+r_{d,\,t} = E_t\,[s_t\,(1+r_{f,\,t})/\,s_{t+1}]$$

This is equivalent to combining the CIP condition with the assumption that exchange rates are driven, at the margin by risk neutral market participants who stand ready to take uncovered spot or forward positions whenever the forward rate deviates from the expected future spot rate.

Redeckaite and Sokolovska (2004), explains that there are two basic methods of testing whether UIP holds in practice. One is regressing interest rate differentials on exchange rate differential. This test expects that the correlation coefficient between the two differences be positive and close to unity. Another is checking for the existence of interest rate arbitrage between the two countries, if it is possible to consistently earn abnormal profits i.e. returns above zero by engaging in interest rate arbitrage, the UIP hypothesis can be rejected.

Kirikos, (2002) underscore that some analysts have expressed their skepticism about the usefulness of the particular regression methodology and have turned to a more appealing specification whereby the ex-post change in exchange rate is projected on the lagged forward premium or discount. Under the latter, UIP relationship is identified with the unbiasedness of the forward exchange rate as a predictor of the future spot rate which requires that the coefficient of the forward premium should not be significantly different from unity and that the error term be serially uncorrelated.

However, according to Diez de Los Rios and Sentana, (2007), some studies reject the null hypothesis that the slope coefficient is one, in fact, a robust result is that the slope is negative. This is known as the "forward premium puzzle" and implies contrary to theory that high domestic interest rate relative to those in the foreign country predict a future appreciation of the home currency. This involves borrowing low interest currencies and investing in high interest rate ones known as Interest Arbitrage and constitutes a very popular currency speculation strategy developed by financial market practitioners to exploit this anomaly.

Fama (1984) provided evidence on the Uncovered Interest Parity-Covered Interest Parity-Rational Expectations hypothesis (UIP-CIP-RE) when he focused on statistical properties of this relation. He finds that from the end of August 1973 to the end of 1982, the variance of the exchange risk premium was large, exceeding the variance of expected future spot rates changes of the dollar against each of ten other major currencies (over monthly intervals).Not only was the interest rates parity rejected, but also a negative covariance over time between the exchange risk premium and the expected change in the corresponding spot rate was observed. Economists often call this empirical result the "forward discount bias puzzle".

Chinn and Meredith (2004) using long horizon regression to test UIP on the G-7 countries i.e. using interest rate on longer maturity bonds, found strong evidence for the G-7 countries that the perverse relationship between interest rates and exchange rates is a feature of the short-horizon data that have been used in almost all previous studies. Using longer-horizon data, the standard test of UIP yields strikingly different results, with slope parameters that are positive and closer to the hypothesized value of unity than to zero thereby confirming the UIP at long time horizons

Redeckaite and Sokolovska (2004) in testing the UIP hypothesis in Latvia, using the Interest Arbitrage basket hedge portfolio from the Latvian lat and SDR (special drawing rights) currency basket to check for the presence of interest rate arbitrage. They found out that an investor could achieve abnormal returns averaging 4-5% annually from almost riskless interest arbitrage. This shows that UIP between the Latvian lat and the SDR basket of currencies did not hold at some points in time from 1999-2003.

Bekaert et al (2005) examined uncovered interest rate parity (UIRP) and the expectations hypotheses of the term structure (EHTS) at both short and long horizons using vector auto-regression (VAR) on exchange rate changes, interest rates and term spreads, and drawing data from three countries: the US, the UK and Germany. The statistical evidence against UIRP was mixed and was currency- not horizon-dependent. Economically, the deviations from UIRP were less pronounced than previously documented studies. They found no evidence against UIRP at either the 3-month or the 60-month horizon in the USD-DEM system at the 5% significance level. For the USD-GBP system, the results were more mixed. The LM test marginally failed to reject the null at the 3-month and the 60-month horizon separately in the 5-variable VAR. However, in the 7-variable systems they rejected UIRP at the 5% level for short horizons but failed to reject at long horizons.

Mehl and Cappiello (2007) used the standard Fama (1984) equation as a starting point and estimated it over selected long horizons , namely ten, five and two years.. At the ten-year horizon, the estimates for US dollar rates vis-à-vis mature economy currencies were close to those of Chinn and Meredith (2004, 2005) and Chinn (2006). In almost all cases, the estimated slope coefficient β was positive and significant, thereby accepting the UIP hypothesis.

Ray (2012) test the validity of uncovered interest rate parity in India based on a theoretical formulation in line with economic theory. Although KPSS test suggest that excess return series are in stationary process, excess return curve shows erratic behaviour during some months of their study period (showing negative trend) which automatically excludes the possibility for the UIP to hold. The UIP regression estimate indicates that there

is no statistically significant evidence that suggests the uncovered interest rate parity to hold during January, 2006 –July, 2010 for domestic interest rate (weighted average call money rate).This indicates that interest rate spread is a very poor predictor of exchange rate yields. Thus, the UIP hypothesis fails in India.

2.1 WHY THIS STUDY?

It is evident from the available reviewed literature that several attempts have been made at conducting studies on Uncovered Interest Parity, However, it is observed that empirical findings are mixed and often conflicting. Therefore for a more consensus result, it is imperative that further studies be carried out for different economies with different economic conditions.

In addition, most of these studies involving UIP have conducted empirical tests using data for mainly the advanced industrialized countries rather than the developing countries presumably due to lack of time series data of sufficient duration for the latter countries. A growing body of literature such as Tanner (1998), Ferreira and Leon-Ledesma (2003), Fuji and Chinn (2002), Flood and Rose (2001), have tested the validity or otherwise of this Uncovered Interest Parity in some countries of Africa, Asia and Latin America. Surprisingly, from available studies at disposal, there is no evidence of previous similar research made in Nigeria, which constitutes a considerable research gap in the knowledge about fundamental features of the local financial markets. As a result, more studies need to be carried out in less developed countries of Africa in general and Nigeria in particular. This current study attempts to bridge this gap, it is aimed at testing whether Uncovered Interest Parity doctrine holds practice in Nigeria using annual data for the period, 1970 -2005.

Furthermore, many of these studies have used relatively short time periods to study this long-run relationship and its short-run dynamics. As such, these studies do not adequately explore the long-run relationship existing between/among the exchange rate, domestic interest rate, and foreign interest rates implied by the UIP theory without due consideration given to issues such as causality and short-run dynamics within the hypothesized long-run framework. As such this study makes use of a longer period of data i.e. 36 observations as opposed to 10 -15 observations which most studies made use of as we see from the review. These limitations constitute the motive around which this study is centered.

3.0 METHODOLOGY AND DATA

3.1 THE MODEL

3.1.1: Conventional UIP Model

The uncovered interest rate parity (UIP) is an equilibrium condition stating that the expected return on domestic asset denominated in domestic currency should equal the expected return on foreign asset denominated in foreign currency, if they only differ with respect to the currency of denomination. By implication, UIP states that the change in nominal exchange rate of domestic country should equal the change in interest rate differentials between the domestic country and the foreign (anchor) country (USA). Under rational expectations, the actual ex-post change in the exchange rate at time 't' should be a good proxy for the expected change. It is stated mathematically as:

$$\Delta E_t = f\left[\Delta(i - i^*)_t\right] \quad \text{..... (3.1)}$$

where E is the nominal exchange rate of domestic country, i is the nominal interest rate of domestic country, i* is the nominal interest rate of anchor country (USA) and Δ is the first difference operator. The UIP for Nigeria is therefore stated as:

$$\Delta E_{Nigt} = f\left[\Delta(i_{Nig} - i_{USA})_t\right] \quad \text{..... (3.2)}$$

or in log form as:

$$e_{Nigt} = f\left[\text{int}_{(Nig/USA)t}\right] \quad \text{..... (3.3)}$$

where e_{Nigt} is the log of ΔE_{Nigt} and

$f\left[\text{int}_{(Nig/USA)t}\right]$ is the log of $f\left[\Delta(i_{Nig} - i_{USA})_t\right]$

The empirical form of equation (3.3) is given below:

$$e_{Nigt} = \beta_1 + \beta_2 \text{int}_t + \nu_t \quad \text{..... (3.4)}$$

where

$e_{Nigt} = \left[\dfrac{e_{Nigt} - e_{Nigt-1}}{e_{Nigt-1}}\right]$ is the change in Nigeria's nominal exchange rate at time t,

$\text{int}_t = \text{int}_{(Nig/USA)t} = \left[\dfrac{\text{int}_{Nigt} / \text{int}_{USAt} \_ \text{int}_{Nigt-1} / \text{int}_{USAt-1}}{\text{int}_{Nigt-1} / \text{int}_{USAt-1}}\right]$ is the interest rate differential between Nigeria and the USA at time t,

ν_t is the stochastic error term at time t.

3.1.2: Causality Relationships between Exchange Rate and Interest Rate Differential.

The study also examines the causal relationship between/among the variables appearing in the UIP relationship, i.e., exchange rate, domestic interest rate, and the foreign interest rate. The tests will be conducted using the E.C.M framework of the Granger causality. The bivariate causal relationships being examined here focus on causality between the exchange rate and the interest rates of Nigeria *vis-a-vis* United States. The causality tests are expected to detect various possible causal linkages (uni-directional causality, bi-directional causality, or independence (no causality) between the relevant variables. On an intuitive level, the standard Granger causality test examines whether past changes in interest rate differential help to explain current changes in exchange rate, over and above the explanation provided by past changes in exchange rate itself. If this is true, then we conclude that interest rate differential Granger causes exchange rate; otherwise, the former does not Granger cause the later.

To determine whether causality runs in the other direction, one simply repeats the above experiment, but with the variables interchanged. Four possible outcomes are possible: (1) Unidirectional causality: interest rate differential Granger causes exchange rate , but not vice versa; (2) Unidirectional causality: exchange rate Granger causes interest rate differential, but not vice versa; (3) Bi-directional causality: exchange rate Granger causes interest rate differential and interest rate differential Granger causes exchange rate ; and (4) Independence: neither variable Granger causes the other. Below is the model for Granger causality test.

$$\left.\begin{aligned} e_{Nigt} &= \sum_{i=1}^{n} \alpha_1 e_{Nig\,t-1} + \sum_{i=1}^{n} \beta_i Int_{t-i} + \mu_{1t} \\ Int_t &= \sum_{i=1}^{n} \pi_1 Int_{t-1} + \sum_{i=1}^{n} \lambda_i e_{Nig\,t-i} + \mu_{2t} \end{aligned}\right\} \quad \text{..... (3.5)}$$

It is assumed that the disturbances μ_{1t} and μ_{2t} are uncorrelated.
However, the application of the standard Granger test requires that the variables, e_{Nigt} and int_t, be stationary. Otherwise we apply the ECM framework to examine the Granger Causality instead of the Standard Granger Causality test.

$$e_{Nigt} = \sum_{i=1}^{n} \alpha_1 e_{Nig\ t-1} + \sum_{i=1}^{n} \beta_i Int_{t-i} + \varpi_1 \psi_{t-1} + \mu_{1t} \quad \text{..... (3.6)}$$

$$Int_t = \sum_{i=1}^{n} \pi_1 Int_{t-1} + \sum_{i=1}^{n} \lambda_i e_{Nig\ t-i} + \varpi_2 \varphi_{t-1} + \mu_{2t}$$

Where

e_{Nigt} and Int_t are established first-differenced stationary, co-integrated time series. ψ_{t-1} and φ_{t-1} are lagged value of the error term and must be stationary if the first differenced e_{Nigt} and Int_{t-1} series are co-integrated. Therefore, the inclusion of ψ_{t-1} and φ_{t-1} differentiates the error-correction model from the usual Granger causality regressions. Based on equation **3.6,** the null hypothesis that Int_{t-1} does not Granger cause e_{Nigt} now, is rejected not only if **β** and λ are jointly significant, but also if the coefficient on ψ_{t-1} and φ_{t-1} is significant. More specifically, the error-correction model helps in capturing the short-run dynamic adjustment of the variables in concern.

3.2: MODEL JUSTIFICATION

Normally, the hypothesis of UIP which states that market forces equilibrate the expected return on an uncovered investment in a foreign currency to the return on the riskless option of investing in local currency is stated as:

$$Ee_{Nigt} = \beta_1 + \beta_2 \text{int}_t + \nu_t \quad \text{..... (3.7)}$$

where E is the expectations operator.

Testing UIP normally involves combining it with the assumption that investors have rational expectations and that the expected future spot rate, even if not observable in itself, can be regarded as an unbiased predictor of the actual future spot rate.

But the UIP hypothesis in itself as expressed by equation (3.7) is, however, not very interesting and popular. The absence of reliable data for the expected future exchange rate makes it difficult to reach definitive conclusions about its validity. As a result, researchers often test the doctrine in the form stated in equation (3.4) where the actual ex-post change in the exchange rate at time 't' become a good proxy for the expected change. Hence, the expected change between time t + 1 and t transforms to observed change between time t and t – 1. Following Hodrick (1987), Froot and Thaler (1990), Engel (1996), Chinn and Meredith (2002) and other researchers, we adhere to the UIP equation as stated in equation (3.4).

The Granger causality test has been widely used in economics, but the use of the standard Granger causality test (which does not account for the error correction mechanism) is subject to more criticism than the more advanced Granger causality test based on the ECM model. The application of the standard Granger test involving two variables x and y, requires that the variables, x and y, be stationary. Since most economic variables are non-stationary in level forms, the standard Granger causality test is conducted using regressions based on appropriately differenced stationary variables. This differencing process throws away useful long-run information about causal relationships among the variables. Therefore, it is advisable to apply the ECM framework to examine the Granger causality issue instead of the standard Granger method, following Islam and Ahmed (1999), Gupta and Komen (2008). The methodology developed by Granger (1983, 1986) and Engle and Granger (1987) provides a more sophisticated and more comprehensive test of causality which is applied within

the co-integration and error-correction model (ECM). This advanced framework specifically allows for a causal linkage between two variables stemming from a common trend or long-run equilibrium relationship. Such causality may not be detected by the standard Granger test, which examines only short-run information given by the past changes in a variable, x , which help explain current changes in another variable, y. The ECM framework can also be used to detect the possibility of having reverse or even bi-directional causality. As long as x and y have common trends, however, causality must exist in at least one direction within this ECM framework. Thus in the ECM framework, the possibility of finding no causality in either direction (one of the possibilities with the standard Granger test) is ruled out when the variables share a common trend (co-integrated).

3.3. ESTIMATION TECHNIQUE

The first objectives one of this study will be achieved by estimating equation (3.4) using the Ordinary Least Square (OLS) technique. The choice of OLS is due to its popularity in estimating time series econometric models. The parameter estimates of OLS regressions normally have the BLUE property. In equation (3.4), the coefficient of interest is β_2. If β_2 is found to be statistically indistinguishable from unity, the null of hypothesis one will be rejected. Otherwise (if the parameter is different from one), the non-rejection of the null hypothesis will be the case.

Objective two will also be achieved by estimating equation (3.5) using the same OLS technique. Here, the null hypothesis will be accepted (rejected) depending on the magnitude of the t-statistic resulting from the estimation of this equation. A unit root test will finally be conducted to test the mean reversion status of the Nigeria's exchange rate.

3.4: THE UNIT ROOT TEST

In an effort to test the stationarity of Nigeria's exchange rate, we employ the Augmented Dickey Fuller (ADF) univariate unit root test. Equation (3.8) expresses the model for ADF test (Dickey- Fuller, 1981), when only a constant is included**.**

$$\Delta e_{Nigt} = \beta_1 + \beta_2 e_{Nigt-1} + \sum_{i=1}^{\pi_{Nigt}} \varpi_{Nig_j} \Delta e_{Nig_{t-1}} + \psi_t \ldots\ldots\ldots\ldots\ldots\ldots (3.8)$$

where e_{Nigt} **is the log of the Nigeria's exchange rate.**

β_2 is the mean reversion parameter, β_1 is the intercept parameter, ϖ is the coefficient on the lagged real exchange rate returns, π_{Nigt} denotes the number of lags needed for Nigeria's interest rate, and ψ_t is the white noise error term at time t. The null hypothesis therefore, is that Nigeria's exchange rate has a unit root. Lag selection (value of π_{Nigt}) will be determined by the Akaike Information Criteria.

3.5 DATA AND ECONOMETRIC SOFTWARE

The exchange rate and interest rate data for Nigeria were obtained from the Central Bank of Nigeria (CBN) statistical bulletin (various issues). The interest rate data for U.S.A. was obtained from the Federal Reserve Bank. The United States data is used as the anchor data. All data series are annual and span the period from 1970 to 2005. The E-Views software was used for the analysis**.**

4.0 EMPIRICAL RESULTS

4.1 THE VALIDITY OF THE UNCOVERED INTEREST PARITY

Table 1: MODELING EXCHN BY OLS

Dependent Variable: EXCHN

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.185481	0.099839	1.857809	0.0719
INTT	0.493163	0.300265	1.642426	0.1097
R-squared	0.073508	Mean dependent var		0.227554
Adjusted R-squared	0.046258	S.D. dependent var		0.592853
S.E. of regression	0.578978	Akaike info criterion		1.798848
Sum squared resid	11.39733	Schwarz criterion		1.886822
Log likelihood	-30.37927	F-statistic		2.697564
Durbin-Watson stat	1.827014	Prob(F-statistic)		0.10972

Table 1 above shows the estimate of equation 3.4 with the slope (0.493163) being the point estimate of β. The non-heteroscedastic standard error is also shown in table 4. Also shown in the table are the t-statistic, t-probability, and the regression's R^2 and others. This result does not support the validity of the Uncovered Interest Parity due to the fact that β is not equal to unity in economic and statistical terms. The slope as seen from above is not different from the null hypothesis of $\beta \neq 1$.

Table 2: ADF UNIT ROOT TEST FOR NIGERIA'S EXCHANGE RATE

ADF Test Statistic	-8.318248	1% Critical Value*	-4.2712
		5% Critical Value	-3.5562
		10% Critical Value	-3.2109

*MacKinnon critical values for rejection of hypothesis of a unit root.

Table 3: ADF UNIT ROOT TEST FOR NIGERIA'S INTEREST RATE DIFFERENTIAL

ADF Test Statistic	-10.01405	1% Critical Value*	-4.2712
		5% Critical Value	-3.5562
		10% Critical Value	-3.2109

*MacKinnon critical values for rejection of hypothesis of a unit root.

Table 4: HETEROSCEDASTICITY TEST FOR NIGERIA

White Heteroskedasticity Test:

F-statistic	0.670101	Probability	0.518481
Obs*R-squared	1.404979	Probability	0.495351

Table 2 shows the estimated result for equation 3.8, which is the equation that estimates the mean reversion in Nigeria's exchange rate. The ADF unit root test for Nigeria's exchange rate has the following critical values: -4.27 for 1%, -3.56 for 5% and -3.21 for 10% levels of significance. At all levels, the ADF test statistic (-8.32) is greater in absolute term. Therefore we reject the null hypothesis of the existence of unit root and conclude that Nigeria's exchange rate is mean reverting.

Table 3 also shows the ADF unit root for Nigeria's Interest rate Differential. It has the following critical values: -4.27 for 1%, -3.56 for 5%, and 3.21 for 10%. In all cases also, the ADF test statistic (-10.014) is also greater in absolute term. Therefore, we also reject the unit root hypothesis, concluding that Interest rate differential is also mean reverting.

The stationarity of both variables at the same order of integration is enough to suspect co-integration,

and its existence would provide an evidence of a long-run relationship between the variables: EXCHN and INTT.

4.2: CAUSALITY RELATIONSHIP BETWEEN EXCHANGE RATE AND INTEREST DIFFERENTIAL.

This section provides an empirical result of the causality test as provided in equation 3.6 (empirical equation used in testing hypothesis 2). From table 5, it is observed that the t-statistc for EXCHN (the upper equation of the equation 3.6) is -4.07990, which is very high in absolute term. This result however provides an evidence of the rejection of the null-hypothesis. (Note that the null hypothesis in this case states that EXCHN does not Granger cause INTT. Conversely, the absolutely low value of the t-statistic (-0.69911) of INTT which is also provided in table 5 is enough to accept the null-hypothesis (INTT does not Granger cause EXCHN) of the lower equation of equation 3.6.
Given the above result, the uni-directional causal linkage between the two variables is no longer contentious as only EXCHN causes INTT. See table 5 below.

Table 5: CAUSALITY TEST FOR EXCHN AND INTT
Standard errors & t-statistics in parentheses

Cointegrating Eq:	CointEq1	
EXCHN(-1)	1	
INTT(-1)	-1.96101	
	-0.61023	
	(-3.21355)	
70	-0.00766	
	-0.00816	
	(-0.93813)	
C	0.08008	
Error Correction:	D(EXCHN)	D(INTT)
CointEq1	-0.623705	0.458128
	(-0.30514)	(-0.13706)
	(-2.04397)	(-3.34266)
D(EXCHN(-1))	-0.232572	-0.473776
	(-0.25854)	(-0.11612)
	(-0.89955)	(-4.07990)
D(EXCHN(-2))	-0.06322	-0.290557
	(-0.21892)	(-0.09833)
	(-0.28878)	(-2.95497)
D(INTT(-1))	-0.690416	0.146813
	(-0.46755)	(-0.21)
	(-1.47667)	(-0.69911)
D(INTT(-2))	-0.522288	-0.035255
	(-0.39616)	(-0.17793)
	(-1.31838)	(-0.19814)
C	-0.008601	-0.011539
	(-0.12631)	(-0.05673)
	(-0.06810)	(-0.20340)

5.0 SUMMARY, CONCLUSION AND POLICY RECOMMENDATION

5.1 SUMMARY/ CONCLUSION

This study has examined one of the most basic puzzles in international finance. This puzzles boils down to whether Uncovered Interest Parity holds across borders. Its importance stems from the fact that UIP is a cornerstone in most exchange rate determination models.

The study employed the conventional UIP equation to test the validity of the theory for Nigeria vis-à-

vis the United States of America, using annual data for the period 1970 to 2005. The result as discussed in the previous chapter led to the non-rejection of the invalidity of the UIP theory for Nigerian Naira/ United States dollar exchange rates. We hereby conclude that the existence of abnormal profits from interest arbitrage means that the Uncovered Interest Parity between Nigeria and the U.S.A did not hold in reality at some points between 1970 to 2005.

However, the reasons for the failure of UIP theory for Nigeria might be that the capital mobility between the countries is not perfect, or the risk premium in Nigeria is high as perceived by the potential investors. Country risk, which includes political risk and economic risk remain higher for developing countries including Nigeria, than for the developed countries. This could make investors reluctant to invest into the Nigerian money market, leading to abnormal returns among few investors present. The threat of loses for foreign investors arises in case of currency devaluation or high default probability of the banks. In addition, unstable political situation threatens to end up in economic instability, or in case of unclear priorities of the government, regulations putting barriers on capital mobility might be adopted. Some of those considerations might possibly prevent investment into the Nigerian Naira, even though the extraordinary profit could be made in interest arbitrage.

In achieving the second objective, the study went ahead to evaluate the causal relationships between Nigeria's exchange rate and her interest rate relative to that of the USA. Instead of the Standard Granger Causality test, and subject to the non-stationarity of most economic variables at level form, we introduced the ECM framework in testing this causality relationship. As highlighted in section 4.2, the causal linkage is uni-directional running from exchange rate to interest rate differential (i.e EXCHN granger causes INTT).

However, given the conventional UIP equation which specified the domestic country's exchange rate changes to be a function of its exchange rate relative to the interest rate of the anchor country (USA for this study), the causality status of our test as earlier discussed proved that there is indeed a long run relationship existing between the two variables. But the puzzle lies on the direction of the flow of this relationship, resulting from the fact that we found interest rate differential to be the dependent variable, becoming a function of exchange rate changes (EXCHN granger causes INTT).

On this note, we conclude that though there exist a long-run relationship between our variables of interest, the biasness in the slope coefficient estimate of the conventional UIP test may equally be debatable. This issue calls for further research on this study. This change does not lead to an inflow of foreign investments. It is of interest to know that foreign investors will always evaluate first, the macroeconomic situation of the country before making investment decisions.

5.2: POLICY RECOMMENDATIONS

Having emphasized the macroeconomic importance of the validity of the Uncovered Interest Parity for countries, the result obtained from the test of the hypothesis in Nigeria as discussed in section four imply that foreign investors were able to make extraordinary profits by following certain investment strategies in pursuing interest rate arbitrage with the Nigerian Naira and the USA dollar for the period 1970-2005.

Convergence and its extreme case of interest parity, present national monetary authorities with the question of how to use monetary policies effectively. In an open economy like Nigeria, a necessary pre-condition for monetary policy transmission mechanism to function successfully is to allow real rates to differ across countries by controlling nominal rates. To facilitate this, with reference to section 5.1, we recommend the following:

1. The monetary authorities in Nigeria should make and implement policies that aim towards enhancing perfect capital mobility across Nigeria's borders.
2. The Nigerian government should create a conducive environment for foreign investors by neutralizing political and economic risks, capable of discouraging such investments.
3. The Nigerian money market be re-organized, re-structured, diversified and managed to an international standard. This will go a long way in attracting foreign investors.
4. Arbitrageurs within the monetary market should not only make every effort towards discovering all possible interest arbitrage opportunities i.e. tracing profit opportunities associated with very low investment risks, but communicating same opportunities to world investors.

However, this study can also find application in various spheres, the existence of arbitrage opportunities might instigate a speculative attack on the Nigerian currency, which might negatively affect foreign currency reserves. Therefore, the Nigerian policymakers could take this study as a plausible reference for the analysis of past situations in the money market, as well as apply the model developed in the study as a tool for monitoring the parity condition on daily basis so as to prevent occurrence of arbitrage opportunities in the future as well as enhance efficient and proficient working of the market.

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