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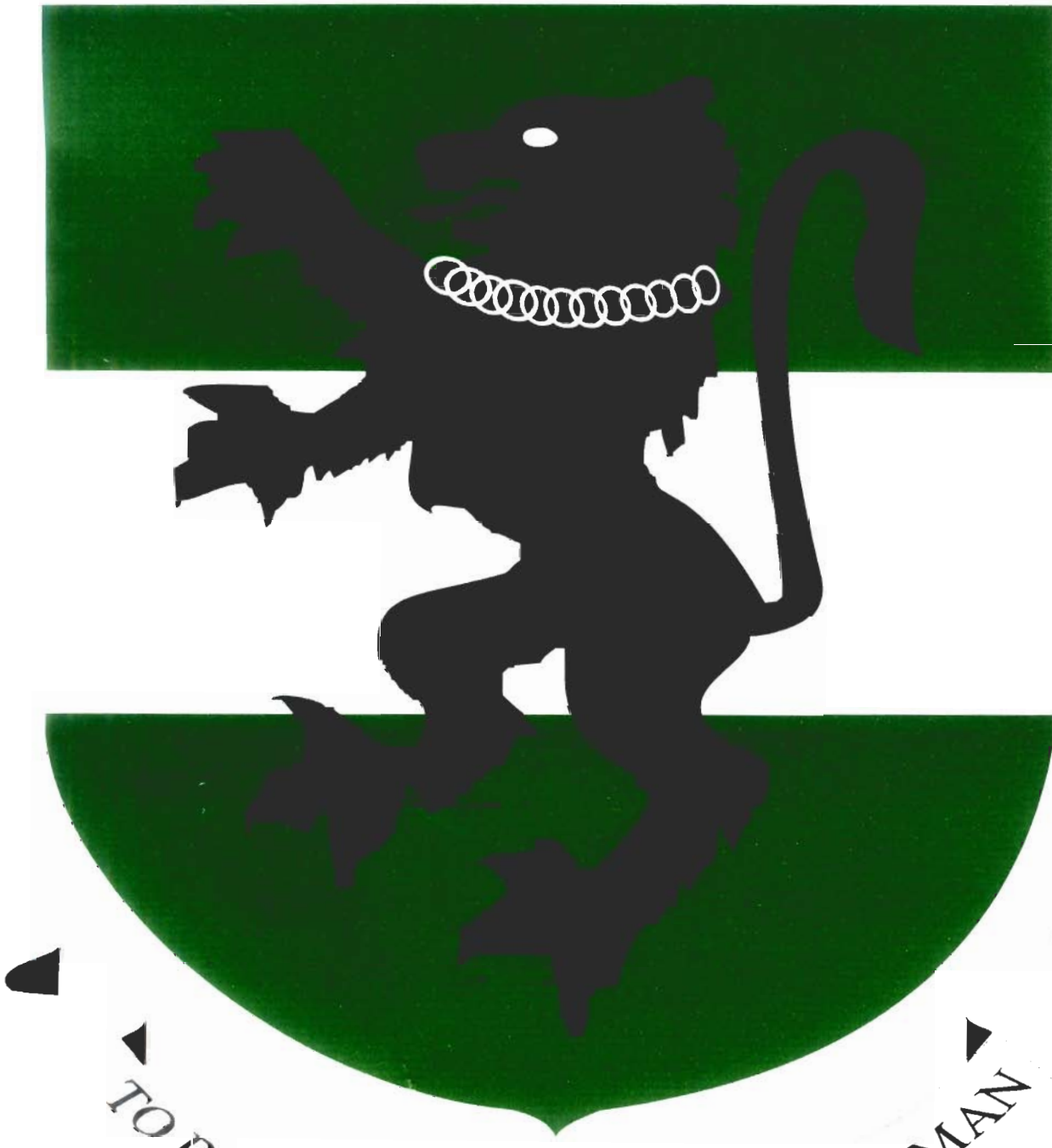

AN EMPIRICAL ANALYSIS OF PURCHASING POWER PARITY: A CASE OF TWO ANGLOPHONE ECOWAS MEMBERS.

BY

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A RESEARCH WORK PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A DEGREE OF MASTER OF SCIENCE (M. SC.) IN THE DEPARTMENT OF ECONOMICS, FACULTY OF THE SOCIAL SCIENCES, UNIVERSITY OF NIGERIA, NSUKKA.

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CERTIFICATION

This project has been supervised and approved as having satisfied the conditions for the award of Master of Science Degree in the Department of Economics, University of Nigeria, Nsukka.

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DEDICATION

This research work is highly dedicated to **God almighty (the starter and finisher of everything)** for seeing me through. The next are my parents, **Mr. and Mrs. G.I. Oguanobi; my Grand mothers, Mrs. Elizabeth Egwuatu** and **Mrs. Sussana Oguanobi**, for their unquantifiable support, (financially and otherwise); and my academic father, **Mr. Anthony Akamobi** for his significant impacts. **To God be the glory.**

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ABSTRACT

This paper tests the validity of Purchasing Power Parity (PPP) hypothesis for two Anglophone ECOWAS members, Nigeria and Ghana. The researcher tested the relative PPP equation. It also employed the ADF univariate Unit Root test for the stationarity of the exchange rates of each of the countries. Exchange rates and CPIs data for all countries were collected on annual basis for the period between 1970 and 2005. The results show the non-rejection of the null hypothesis of the failure of PPP for both countries. The results of the unit root tests show that exchange rates of both countries follow mean reversion. Their respective exchange rates and inflation differentials were found to be stationary at the same order of integration. Consequently in both cases, cointegration is suspected, though this study did not investigate the evidence of cointegration because even if it exists, evidence of long-run relationship between NIGEX and NIGINF, GHANEX and GHANINF is provided. The study went ahead to establish that the purchasing power of Ghanaian Cedi is superior to that of Nigerian Naira. From the policy point of view, PPP can be used to assess the levels of exchange rates.

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CHAPTER ONE

1.0 INTRODUCTION

1.1: Background Information

One of the most provocatively debated issues in international macroeconomics literature pertains to whether or not Purchasing Power Parity (PPP) holds across borders. The doctrine of PPP in its various forms states that a common basket of goods, when quoted in the same currency, costs the same in all countries. As such, the theory represents an application of the 'Law of One Price' (LOOP). This law states that in the presence of competitive market structure and the absence of transport cost and other barriers to trade, identical products which are sold in different countries will sell at the same price when expressed in terms of a common currency (Pilbeam, 1992). The parity condition rests on the assumption of perfect inter-country commodity arbitrage and is the central building block of many theoretical and empirical models of exchange rate determination. However, the implication of this theory is that a country with inflation higher than that of her trading partner(s) will tend to have a depreciating currency.

It is known a 'priori' that PPP is an exact relationship and it holds under certain circumstances. Although earlier studies, like Froot and Rogoff (1995) had reported evidence of short run violations, many economists like McDonald (1996), Wu (1996) and others still hold the view that over the long run, relative prices may move in proportion to the nominal exchange rate so that real exchange rate will exhibit mean reversion. Hence, the imperativeness of testing PPP for long run relationship.

Therefore, this study which broadly aim at comparing the purchasing powers of the currencies of two West African neighbours namely Nigeria and Ghana, will

bilaterally test the long-run validity or otherwise of the PPP doctrine individually for each of the countries. The world number one with respect to the values of all categories of GDP (IMF database, 2005) remains the numeraire country. However, for comparison purpose, it is worth highlighting some striking and relevant features of the two ECOWAS members included in the study.

The first feature is that both countries rely on exportation of primary products for foreign exchange earnings. The products are agricultural such as Cocoa in the case of Ghana and Crude Oil in the case of Nigeria. Secondly, they are basically price takers in international export markets. Due to weak manufacturing base, these countries depend on imported manufactured goods from industrialized countries. They are also price takers in the import markets. The third feature is that inter-country trade between the two countries like every other African country is small. This is sequel to poor infrastructures and high transaction cost. It is of interest to note that Nigeria and Ghana had different exchange rate regimes overtime, although the current trend is that they are adopting more flexible regimes (Nagayasu, 1998). Finally, in line with 2005 GDP data, the IMF ranked Nigeria fourth in Africa and forty-seventh in the world while Ghana was ranked tenth in Africa and seventy-fifth in the world. In the light of these particular attributes of these countries, it is not unwise to investigate the extent to which the changes in the nominal exchange rate of each are affected by her output's price level relative to that of her trading partner (USA).

According to literature, PPP is more likely to hold among countries with similar consumption patterns and the same inflation trend. Generally PPP has been found to hold in high inflation countries (Rogoff, 1996). However, this study aims at testing the

validity of PPP theory for the aforementioned West African Countries, and finally comparing the economies of both countries with respect to the purchasing power of their currencies.

1.2: Statement of the Problem

A problem that has challenged economists comparing economies across national boundaries is that variables such as Gross Domestic Product (GDP) of countries are expressed in their respective national currencies. Imagine you are planning a trip to France and would like to figure out how much currency you will need during your visit. You would need to know how much in French francs it would cost for incidentals such as meals, sightseeing, and souvenirs. What information would be helpful to you in making your estimate? You could check the price of, say, a lunch in your hometown and then convert that figure into francs using the exchange rate. This type of estimate would not be very accurate, however, because it is likely that a lunch in your hometown costs relatively more or less than a lunch in France. A better estimate would be based on the price of a lunch in France (Vachris and Thomas, 1999). Similarly, if you were opening a subsidiary company in Ghana, how would you determine the salaries for your employees? Again, using the exchange rate to convert the salary you would pay in Nigeria into cedes would not be accurate. To adequately compensate employees crossing the boarder, you would need information about the cost of living in Ghana. Finally, if a government or international organization were comparing national expenditures across different countries, merely collecting the gross domestic products (GDPs) of the countries and using exchange rates to convert them into a single currency would not yield an accurate comparison. Again, the comparison

based on exchange rates does not take into account differing prices among the countries. In each of these scenarios, analysts could construct better estimates if they convert the data into a common currency and value it at the same price levels. While exchange rates can be used for this comparison, analysts find it to be deficient because of the effects of non-traded goods and services, capital movements, and exchange market interventions. However, this requires that national levels of GDP be converted into a common currency before the comparison can be made.

The long-standing recognition of these deficiencies led to the development of PPP as a more appropriate currency converter to compare GDP and its components across countries. Because exchange rate movements, in general tend to be more volatile than changes in national price levels, the PPP approach provides the proper basis for comparing living standards and examining productivity levels overtime. The relationship between the Euro and US dollars provides a good example. In 2002, it took US$.91 to purchase a Euro, while in 2004 it took US$1.21. This has occurred during a period when both regions experienced low rates of inflation and moderate growth rates. This means roughly that a Euro country had an exchange rate converted GDP relative to the US. that was much higher in 2004 than in 2002. Clearly the use of exchange rates gets both the level and changes of the productive capacity of countries wrong (Vachris, 1993).

If a Big Mac with medium drink in the Philippines, for example costs 107 Poses in July 2004 compared to $3.99 in the USA, the ratio of the prices in poses divided by the US price is the basic example of PPP between the Philippines and the USA. The ratio, 26.8 imply that 26.8 poses have the same purchasing power as one US.

dollar. To compare the Philippine's economy with that of the US, using the PPP based on the Big Mac index, the Philippine's GDP would be higher than its value when exchange rate is used. In reality, Purchasing Power Parities are prepared using relative prices for a very large number of comparable goods and services because the levels of price differences differ between different items and parts of the globe. This is another reason why PPPs should be used instead of exchange rates for comparison purposes (Vogel, 2005).

The pervasiveness of PPP in macroeconomics has gone hand in hand with the literature on the empirical tests of the theory. Most of these tests have been done for developed countries of Europe, Asia and America. Very few such studies have been done in less developed countries of Africa in general and ECOWAS sub-region in particular.

Consequently, this research is an attempt at testing the validity of the PPP theory for the above-mentioned neighboring Anglophone West African Nations. It will also compare the economies of both countries with respect to the purchasing power of their currencies. Table 1.1 shows some selected African countries and their GDP based on nominal exchange rates and PPP exchange rates.

Table 1.1: List of selected African Countries by GDP based on nominal exchange rates and PPP exchange rates as at December 2006. (All in $m)

COUNTRY	GDP	
	(EXR)	(PPP)
South Africa	225145	587500
Botswana	10808	17207
Seychelles	749	1017
Namibia	6316	14198
Tunisia	30620	93040
Gabon	9124	9514
Libya	50330	72340
Algeria	114322	240800
Sudan	37564	97190
Egypt	107375	334400
Morocco	57407	153250
Eqt.Guinea	9135	25439
Zimbabwe	5540	28304
Ghana	12894	60000
Gambia	507	3017

COUNTRY	GDP	
	(EXR)	(PPP)
Cameroon	18372	40744
Senegal	9242	20482
Côte d' Ivoire	17339	28460
Togo	2240	8945
Djibouti	768	1686
Uganda	9443	48620
Benin rep.	4760	8534
Nigeria	115350	191400
Mali	6191	13532
Kenya	23187	37065
Niger	3550	11260
Ethiopia	13345	73790
Tanzania	12787	27006
Angola	43759	43599
Sierra Leone	1449	4910

Source: International Monetary Fund, World Economic Outlook Database, April 2007.

However, the differences in the two categories of GDP are as a result of the effects of price differences in computing the PPP category. There also exist a large variance between GDP for Nigeria and GDP for Ghana in both categories. The scenario is not different from what is obtainable when we consider the values of exchange rates. When the currencies of different countries are expressed as a ratio of US dollar, they usually have different nominal values. For instance in 2002, it took Nigerian naira 120.5782 units to exchange one US dollar while the same US dollar was exchanged with 7932.6983 units of Ghanaian cedes. In 2003, 129.2224 units of Nigerian naira exchanged a dollar against 8677.3675 units of Ghanaian cedes. In 2004, it was 132.888 units of naira against 9004.6283 units of cedes, while in 2005, it was 131.2743 units of naira against 9072.5425 units of Ghanaian Cedes. (IFS data book, January 2007). The

problem at hand becomes whether or not these currencies have the same real value (purchasing power).

In responding to the above problems, the researcher is interested in unraveling the following research questions:

1) Does the Purchasing Power Parity theory hold for Nigeria?
2) Does the Purchasing Power Parity theory hold for Ghana?
3) In case of violation of the theory in either of the two countries, which economy is better considering the purchasing power of their respective currencies?

1.3: Objectives of the Study

The broad objective of this study is to compare the economies of Nigeria and Ghana with respect to the purchasing power of their respective currencies. Specifically, the study seeks to address the following objectives:

- To test the validity of Purchasing Power Parity theory for Nigeria using bilateral dollar exchange rate.
- To test the validity of Purchasing Power Parity theory for Ghana using bilateral dollar exchange rate.
- To compare the two economies in terms of the purchasing power of their currencies.

1.4: Research Hypothesis

1. Purchasing power parity theory does not hold for Nigeria.
2. Purchasing power parity theory does not hold for Ghana

3. There is no difference between the purchasing power of the Nigerian Naira and the purchasing power of the Ghanaian Cedes .

1.5: Significance of the Study

The macroeconomic policy importance of power parity power estimates can neither be over-emphasized nor disputed. This study will be significant in the following ways: First, the outcome of the study will influence the policy makers in each of the studied countries towards making macroeconomic and structural policies that will converge along the same line as those of its partner. These policies, which may come in the form of elimination of tariff and non-tariff barriers, will enhance trade, economic efficiency and growth, and also foster private sector development.

Consequent upon the close relationship between monetary approach to balance of payment (BOP) and purchasing power parity (PPP), this study will help monetary authorities in both countries to understand the importance of managing real exchange rate and re-establishing international competitiveness which will go a long way in losses reversal in foreign exchange reserves.

Finally, the findings of this study would be used to ascertain whether or not the two countries would return to PPP-oriented rule as a basis for their exchange rate policies in order to maintain international competitiveness as well as to stabilize domestic income.

1.6: Scope of the Study

This study will cover the period from 1970 to 2005. A sample size of 36 is large for time series analysis.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1: Theoretical Framework

In the absence of transportation costs, tariffs and other barriers to trade, and with free trade, the same good should cost the same across national boundaries. Markets enforce the law of one price, because the pursuit of profit tends to equalize prices of identical goods in different countries. Even though short run deviations from PPP may occur, the PPP relationship is expected to hold in the long run. The empirical evidence on the PPP in the long run is mixed. Many studies, such as Edwards (1989), Intal Jr. (1992), Officer (1982), Roll (1979), Frenkel (1981, 1986), Pippenger (1982), Darby (1983), and Frenkel and Mussa (1986) find evidence that are consistent with the hypothesis that deviations from PPP follow a random walk process. This implies that the deviations from PPP are cumulative and permanent such that PPP does not hold. Additional discussion on the empirical evidence on the PPP theory can be found in Levich (1985). The existence of non-tradable sectors and in particular, uneven variation in the ratio of prices of non-tradables to tradables caused by economic growth may cause deviation from PPP. This would be more applicable for developed countries rather than developing economies (McNown and Wallace (1989)). If the PPP relationship holds, national price levels and the exchange rate should form an equilibrium relationship. If E_t is the exchange rate defined as the domestic price of a foreign currency, P_i and P_j are the domestic price index and foreign price index respectively, and t is the time subscript, then the following equation can be

used to describe the PPP relationship:

$$E_t = P_{it} / P_{jt} = R_t \quad \ldots\ldots (1)$$

where R_t represents the relative price of the domestic vis-à-vis foreign prices. If PPP holds perfectly, the coefficient of R_t will assume a value of one. This will indicate that any change in the exchange rate would reflect changes in the relative price levels of domestic *vis-a-vis* foreign goods. This would indicate that the exchange rate and the relative prices would form a cointegrated system. Thus, the PPP test is really a test of cointegration between the exchange rate and the relative prices. In reality, however, Equation (1) may not hold perfectly. Factors other than the two prices may affect the PPP relationship. Further, the PPP may deviate in the short-run from its long-run equilibrium path due to various shocks and disturbances. To incorporate these factors, Equation (1) can be rewritten in an empirically testable form as follows:

$$E_t = \alpha + bR_t + \eta_t \quad \ldots\ldots (2)$$

where the coefficient 'α' would reflect the influence of omitted variables, 'b' is the coefficient of the relative price variable, and η_t would reflect any short run deviation from the long-run equilibrium path due to stochastic shocks. Equation (2) can now be used to test empirically the validity of the PPP relationship. In this formulation, PPP would hold under the joint hypothesis that $\alpha = 0$, $b = 0$ in its strict form and,

in a less strict form, under the hypothesis that $b = 1$.

2.2: Theoretical Literature

Purchasing power parity has a long and contentious history. It constitutes one of the fundamental building blocks in modeling the modern theories of exchange rate determination. The origin of purchasing power theory has been traced to the 16th century Salamanca School of Spain. During the nineteenth century, classical

economists, like **Ricardo, Mill, Goshen and Marshall** endorsed and developed more or less qualified PPP views. The theory, in its modern form, is credited to **Gustav Cassel,** a Swedish economist, who developed and popularized its empirical version in the 1920s (Rogoff, 1996). Cassel was of the view that the nominal exchange rate should reflect the purchasing power of one currency against another. His proposal was that a purchasing power exchange rate existed between any two countries, and it is measured by the reciprocal of one country's price level against another. He wrote that: "At every moment the real parity between two countries is represented by this quotient between the purchasing power of the money in one country and the other. We propose to call this parity 'the purchasing power parity'. As long as anything like free movement of merchandise and a somewhat comprehensive trade between the two countries takes place, the actual rate of exchange cannot deviate very much from this purchasing power parity" (Isard, 1995:58). **Cassel** developed the idea after the collapse of the world financial system during World War I. Before the war, countries followed the gold standard, whereby their currencies were convertible to gold at fixed parities. This implied that relative gold values reflected the exchange rate between any two countries. However, after the war broke out, it was difficult to maintain the gold standard as speculators worried about countries that would devalue so as to gain seignorage revenues. The gold standard was thus abandoned, and countries had to decide how to reset exchange rates with minimal disruptions to prices and government revenues. Cassel thus promoted the use of PPP as a basis for setting relative gold parities. He suggested that cumulative inflation rates from 1914 be calculated, and then be used to Calculate the exchange rate changes needed to maintain PPP. (Dornbusch, 1994;

Rogoff, 1996). He concluded his theory by arguing that the exchange rate must adjust to ensure that the 'law of one price', which applies only to individual goods, must also hold internationally for identical bundles of goods.

According to Taylor (1988), the condition for free trade is that the nominal exchange rate between two countries is equal to the ratio of the two countries price levels. This approach assumes that equilibrium real exchange rates remain constant over time and therefore, the nominal exchange rate movement tends to offset relative price movements.

Officer (1984) opines that PPP is a flow model since it traces the flow of goods and services through the current account to determine the exchange rate.

Despite the Loop assumption that there is perfect competition, there are no tariff or other trade barriers, and no transportation costs, (Froot and Rogoff, 1995) and Rogoff (1996), argue that due to the existence of trade barriers and transportation costs that drive a wedge between prices in different countries, the law cannot hold exactly. Rogoff writes that the wedge depends on the tradability of the goods. For goods, which are highly traded, such as gold, the law holds quite well, whereas for non-traded goods such as big macs, factors such as non-traded inputs, value-added taxes and profit margins militate against the law.

In empirical tests however, no attempt is made to compare identical baskets of goods. Instead, different countries' consumer price indices (CPIs) and wholesale price indices (WPIs) are used (Froot and Rogoff, 1995). The use of these indices to test for absolute PPP (APPP) can most definitely lead to results not supporting this version of the theory. This is because; different countries use different compositions of goods in

the baskets for constructing price indices. Also, since the weights assigned to goods are not necessarily standard, this makes it less likely that *APPP* measured in this way will hold.

However, **Bala (1964) and Chinn (2000)** state several reasons why deviations from PPP occur. Firstly, there may be restrictions on trade and capital movements, which will distort the relationship between domestic and foreign prices. Secondly, speculative activities and official intervention may create a PPP disparity. Thirdly, the productivity bias when there is a relatively faster productivity growth in the tradable sector than the non-tradable sector will result in systematic divergence of internal prices. Fourthly, the prices are sticky and do not move rapidly enough to offset frequent changes in nominal exchange rates. Lastly, the apparent non-stationarity of real exchange rate will be consistent with prevalence of real shocks in the economy. Moreover, an important shock during the past two decades which include large commodity price changes, innovations in the financial sector, imbalance in government budget, differentials in productivity growth and so on, among major industrial countries also generated short-run deviations.

In recognizing the importance of time for commodity arbitrage, **Protopapadakis and Stoll (1983, 1986)** argue that commodity arbitrage takes place across time as well as space. Because arbitrage takes time, the theoretical exchange rates and the commodity prices in the law of one price are forward or futures prices, not spot prices. Since the modern theory of purchasing power parity rests on the modern theory of the law of one price, the theoretical exchange rates and commodity prices in PPP are also forward or futures prices. (Pippenger, 2004)

Clark et al. (1994), explains that many countries undertake corrective measures of their exchange rates based on inflation differentials with partner countries. While fundamental equilibrium exchange rates (FEERs), derived from medium term internal/external macroeconomic balance conditions, are becoming more and more attractive for detecting misalignment in a country's real exchange rate, PPPs remain much easier to compute. Moreover, deviations between FEERs and PPPs have not yet been analysed in empirical studies.

Engel and Rogers (1996, 1998 and 1999) have shown that although "border effects" do matter, a very large share of deviations from parity across countries is accounted for by the effect of currencies, that is, by nominal exchange rate volatility.

In explaining the relationship between PPP and exchange rate in the short-run, **Jenkins (1995)** maintained that exchange rate movements in the short-term are only news-driven. Announcements about interest rate changes, changes in perception of the growth path of economies and the like are all factors that drive exchange rates in the short run. PPP, by comparison, describes the long run behaviour of exchange rates therefore, the economic forces behind PPP will eventually equalize the purchasing power of currencies. However, this process can take years. A time horizon between 4 and 10 years would be typical. However, many empirical studies have supported the above statement that PPP does not determine exchange rate in the short run. The possible interpretations, most of which indicate violations of PPP assumptions, include:

- The existence of trade barriers and transportation costs (Aizenman, (1984); (Rogers and Jenkins, 1995).
- The lack of competition in goods markets (Aizenman, 1985).

- The existence of non-tradable goods and the difference in tastes of different countries (Warnock, 1998).

Pippenger (2004) was of the view that the conventional wisdom that the short-run volatility of exchange rates is excessive is suspect. The primary evidence for excessive variability is that the variance for monthly changes in exchange rates are much larger than the variance for monthly changes in relative CPIs. But there are two serious problems with these variance ratios. First, the thresholds implicit in the modern theory of PPP imply that such ratios should be larger than one. Indeed, the more successful countries are in coordinating their monetary policies, the larger will be these variance ratios. As a result, excess volatility will appear to be the largest when flexible exchange rates are working their best. Second, using consumer price indices based on sticky retail prices artificially increases variance ratios. He also maintained that the large half-life for deviations from PPP remains a major puzzle. It is possible that the modern theory of PPP may help resolve that puzzle. That theory suggests that the long half lives, and the imprecision of the estimates for those half lives, are at least partially the result of the thresholds implied by the modern theory of PPP and the use of spot exchange rates and sticky commodity prices to measure real exchange rates rather than the more appropriate forward exchange rates and prices. According to him, the large increase in the short-run volatility of exchange rates after the collapse of Bretton Woods fundamentally changed the way the profession thought about flexible exchange rates. The idea that exchange rates

are asset prices and the idea that the volatility of exchange rates is 'excessive' are both a direct result of what happened to exchange rates after the collapse of Bretton Woods. But the modern theory of PPP suggests a very different interpretation of the effect of that collapse on volatility. The modern theory of PPP suggests that the volatility of exchange rates increased dramatically after the collapse, not because the volatility became excessive after the move to flexible rates, but because pegged exchange rates artificially restricted the movement in exchange rates as compared to the movement that would have been consistent with purchasing power parity. Even with no change in economic fundamentals, the modern theory of purchasing power parity may be able to

explain the large increase in volatility after the collapse of Bretton Woods.

He concludes by upholding the view that the conventional wisdom about the relevance of PPP is probably wrong. Purchasing Power parity probably works at least as well in a stable monetary environment as with hyper-inflation. Measurement errors and non-linearities have caused the profession to misinterpret the econometric evidence.

However, a number of recent theoretical studies that emphasize the role of transaction costs have turned to nonlinear dynamic adjustment models to explain the behavior of real exchange rates and hence to test PPP (e.g., Michael et al., 1997; Sarantis, 1999; Taylor et al., 2001; Sarno and Taylor, 2002; Taylor, 2003; Sarno et al., 2004). A general finding from these studies, based on the post-1973 floating rate period

data and a battery of real exchange rates, is that some selected rates can be characterized by nonlinear mean reversion.

2.2: Empirical Literature

Historically, Colin Clark published the first comprehensive investigation of the relative value of money in different countries in 1940. This study compared the purchasing power of many currencies across a range of consumption goods. In the early 1950s, Irving Kravis and Milton Gilbert, at the Organization of the European Economic Community (now OECD), used national accounts data to compare national incomes of four western European countries and the United States. The methodology they developed was further refined in benchmark studies for 1970, 1973, and 1975. In the early 1980s, the Eurostat-OECD PPP program was later established independently, with its own methodology, timetable, and mission to compare national incomes and price levels for the European Union and OECD member countries. Benchmark studies were published under this program for 1980, 1985, 1990, and 1993. **(Mishelle and James, 1999)**

The empirical studies on PPP can be categorised into three groups but based on the different types of the tests they apply: (a) the early "correlation" studies, which apply naïve static PPP tests, (b) the unit root test studies: which test for stationarity of the real exchange rates and (c) the cointegration - based studies: which test for cointegration between relative prices and exchange rates. The correlation-type studies (in the late 1970s and early 1980s) found little or no support for PPP, whereas the unit root (in the 1980s) and cointegration based studies (from the late 1980s till

date) provided mixed results with respect to the validity of the PPP doctrine in the long run.

Frenkel (1976) used the relative PPP model thus $s_t = \alpha + \beta P_t + \varphi$ while restricting his time series analysis to Germany's hyperinflationary period. He assumed that foreign price levels were insignificant and hence excluded it from his specification. He estimated the β that is not statistically different from one. He took this to suggest that PPP held, at least in its relative form.

Frenkel (1981) then tested the validity of PPP using data from the U.S.A, U.K., France and Germany during the 1970's and estimated β's ranging from below -1 to over 2. He easily rejected the validity of relative PPP (at least in the short run). Both Rogoff (1996) and Taylor and Taylor (2004) noted that estimates, which differed so far from PPP, became the norm once economists started testing data from more stable countries.

Dumas (1992), Uppal (1993) and **Sercu *et al.*** (1995) develop equilibrium models of real exchange rate determination which take into account transaction costs and show that adjustment of real exchange rate towards PPP is necessarily a nonlinear process. Market frictions in international trade introduce a neutral range, or band of inaction, within which deviations from PPP are left uncorrected, as they are not large enough to cover transaction costs. In this dynamic equilibrium framework, deviations from PPP follow a nonlinear stochastic process that is mean reverting.

Johansen and Juselius (1992) first tested combined PPP and UIP, for the United Kingdom, over the period from 1972Q1 to 1987Q2. They rejected the hypothesis that the PPP relation is stationary by itself. However, they found support for

combined PPP and UIP. Other studies that support the combination of PPP and UIP into a single relationship include Sjoo (1995), and Pesaran et al (2000).

Wu (1996) used the Levin, Lin and Chu (LLC) procedure to test for unit roots for 18 OECD countries. Pooled data on real exchange rates between the US and the OECD countries for the current float was used to test the hypothesis that each series contains a unit root against the alternative that the various series are stationary. When standard ADF and Phillips and Perron (PP) tests were performed on monthly individual real exchange rates, the null was not rejected at conventional significance levels. However, when the panel-based test was performed, the null was rejected at the 1 percent level. The same conclusion was obtained for quarterly and annual data, providing further support for the validity of long-run PPP for the post-BrettonWoods period.

Obstfeld and Taylor (1997), and **O'Connell and Wei (2002)** provide some empirical evidence of the effect of transaction costs in this context. In all these studies, the nonlinear nature of the adjustment process is investigated in terms of a TAR model (Tong, 1990). The TAR model allows for a transaction costs band within which no adjustment in deviations from the PPP takes place –so that deviations may exhibit a unit root behavior– while outside the band, as goods arbitrage becomes profitable, the process switches abruptly to become stationary. Other authors, as Michael *et al.* (1997), Baum *et al.* (2001), employ the exponential smooth transition autoregression (ESTAR) framework to analyze the dynamic behavior of deviations form PPP, finding evidence of nonlinear adjustment.

Papell (1997) used panel data analysis to test for long-run PPP. The main purpose of the study was to examine how much evidence there was against unit roots during the current float for industrialized countries. The following equation was estimated by Feasible Generalized Least Squares (FGLS),

$$\Delta e_{jt} = \mu_j + \alpha e_{jt-1} + \sum_{i=1}^{K} c_{ji} \Delta e_{jt-1} + \epsilon_{jt}$$

where, e is the exchange rate, and j indexes the countries in the panel. Monte Carlo methods were used to compute exact finite sample critical values for the test statistics for the study. Papell's study found strong evidence against the unit root hypothesis for monthly data, but not for quarterly data.

Coakley and Fuertes (1997) also employed a fairly new panel unit root test. They used the Im et al (1997) panel unit root test, which is more powerful than the Levin, Lin and Chu (LLC) procedure, to analyse real exchange rate data for the G-10 countries and Switzerland. They used monthly data for the period from 1973 to 1996 of bilateral rates and wholesale and consumer prices. Since cross-sectional dependence in disturbances is expected in panels on real exchange rates, if a common currency such as the US dollar is used as base, they allow for this by using the demeaning adjustment proposed by Im et al (1997). The demeaning procedure involves subtracting cross-section mean from the observed data. Their findings were that for the wholesale price series, the t-bar statistics rejected the null of a unit root in the real exchange rates at the 5 percent critical value, while for the consumer price series; the null was rejected at the 10 percent level only. They thus concluded that the real exchange rates in their panel are stationary in all cases, and hence rendered support for long-run PPP.

Sarno and Taylor (1998) employed two multivariate unit root tests using panel data. The study provided support for PPP for the post-Bretton Woods period for which the validity of PPP has been most controversial. They employed the tests on monthly data on bilateral real dollar exchange rates among the G-5 countries for the period 1973 to 1996. Both tests enabled them to find "unequivocal evidence of mean reversion in all of the real exchange rates examined."

Nagayasu (1998) examine the validity of long-run PPP using data for 16 African countries. The data used was annual, covering the period from 1981 to 1994. The study applied a panel cointegration technique that was pioneered by Pedroni (1995), and the panel unit root test developed by Im et al (1997) to the parallel market exchange rates expressed in United States dollars and CPIs (Consumer Price Indices). The findings of the study were that the test for unit root and cointegration in individual countries showed that PPP is invalid. However, more reliable results were obtained in the panel context, where the null of non-cointegration was rejected, confirming the semi- strong form of long-run PPP in the 16 African countries.

Krichene (1998) used PPP to study exchange rate and price interdependence in five East African countries, namely Burundi, Kenya, Rwanda, Tanzania and Uganda. The study employed monthly data of bilateral real exchange rates for the period from 1979(1) to 1996(12). The findings of the study were that bilateral real exchange rates revert to long-run equilibrium. Other findings of the study were that the tests for unit roots in bilateral real exchange rates reject the null hypothesis of unit root, hence supporting absolute PPP in the case of Burundi and Kenya, Burundi and Rwanda and Kenya and Rwanda. The result suggests that arbitrage and trade worked well due to the

importance of bilateral trade, proximity of their markets, and rapid transmission of information on prices and profit opportunities. In the case of Tanzania and Uganda, the null hypothesis of unit root could not be rejected for the whole sample period, owing to exchange rate misalignments. However, the null hypothesis was rejected when a sub-period from 1986(1) to 1996(12) was used.

Mollick (1999) utilized the standard unit root test to examine the behavior of the real exchange rate in Brazil over the period 1855 through 1990 (136 years). Contrary to the mean reverting behavior of the real exchange rates reported in Lothian and Taylor (1996) for the industrialized countries, the evidence based on the Brazilian data is mixed.

Using the ADF tests and quarterly data of the synthetic real dollar/euro exchange rate for the period 1985Q1-2001Q4, **Alquist and Chinn (2002)** find that the real exchange rate is nonstationary, suggesting that PPP does not hold for the euro area.

Ogawa and Kawasaki (2003) and Choudhry (2005) utilize the generalized PPP (G-PPP) theory developed by Enders and Hurn (1994) to explain the non-mean reverting behavior of real exchange rates in six East Asian countries[South Korea, Thailand, Indonesia, Malaysia, Singapore and the Philippines] using dollar and yen exchange rates as the USA and Japan represent the two most important trading partners of Asia-6.Briefly, the G-PPP hypothesizes that real exchange rates will share common trends if fundamental variables are sufficiently interrelated Ogawa and Kawasaki investigate the G-PPP between the East Asian countries using data during the pre-crisis period while Choudhry extends the analysis to include the post-crisis period. The sampling period is therefore truncated into two sub-periods. These are (i) January 1976

- June 1997, i.e., the period prior to the Asian financial crisis that coincides with the fast growing phase of the Asian economies; and (ii) July 1997 – September 2002 which constitutes a period of macroeconomic instability and sharp fall in the currencies of the countries affected by the Asian financial crisis.

Interestingly, Choudhry finds evidence of G-PPP between the real rates of the five currencies over the post-crisis period. He concludes that the findings suggest an increased link between the economic and exchange rate policies in the region following the Asian financial crisis.

Gadea *et al.* (2004) analyze the behavior of the real exchange rate of the US dollar versus the European Union (EU) currencies in the post-Bretton-Woods era and test for a weaker version of long-run PPP in the sense that, apart from the permanent effects of some structural breaks on the real exchange rates, "the rest of the observations show a stationary pattern" (p. 1120). Based on the use of some new unit root statistics, introduced in their paper, with two structural breaks appeared in the 1980s, Gadea, *et al.* (2004) find some support for such a weaker version of PPP for period 1974-1996. When they include the observations of the post-euro period, however, they cannot gain evidence for PPP for any currency in their sample.

KTD (2004) also use panel unit root tests to study PPP within the euro zone. Using real exchange rates based on consumer price indices for the euro area countries, they collect monthly data against the US dollar for the period 1973M2- 2003M3. They employ a Seemingly Unrelated Regression (SUR) methodology that not only allows heterogeneous serial correlation between the error terms but also the varying rates of

mean reversion across a panel of real exchange rates. When they impose a common speed of mean reversion, their results are consistent with that of Lopez and Papell (2007) in that PPP tends to hold better within the euro area after the Maastricht Treaty of 1992 when the German mark is used as a numeraire currency. However, relaxing that assumption by allowing different rates of mean reversion produces rather diverse results: while PPP still holds for some of the euro area countries, it does not for many others (6 out of 10 cases). They declare that "...the case of convergence [towards PPP] is not as clear-cut as previous studies imply" (p. 1094). They also find that, save Switzerland, PPP does not hold well between the euro area and other industrial countries.

Sideris (2005) tests for the validity of long-run purchasing power parity (PPP) for seventeen European economies (Estonia, Latvia, Lithuania, Bulgaria, Croatia, Czech Rep., Hungary, Macedonia, Poland, Romania, Slovakia Rep, Slovenia, Georgia, Moldova, Russia, Ukraine and Belarus) in transition. Analysis is performed following the methodological suggestions expressed in Papell (1997). Long-run purchasing power parity was initially tested for each economy vis-a-vis the US using the Johansen Cointegration methodology and then for the whole set of countries using the Larsson et al panel cointegration technique. The analysis provides support for long run equilibria, but the coefficients of the estimated cointegrating vectors violate the symmetry and proportionality hypotheses suggested by purchasing power parity.

Lopez and Papell (2007) apply panel unit root tests to the quarterly real dollar exchange rates for 23 countries from 1973Q1 to 2001Q4. They find strong convergence towards PPP for the majority of the euro area countries starting in 1992 or

1993, coinciding with the adoption of the Maastricht Treaty in 1992. They also test for PPP between euro area and other European countries and find that PPP holds better within the euro zone than between the euro area and other European, negotiating, industrialized, and Mediterranean countries. Moreover, they show that, even within the euro area, evidence for PPP is sensitive to the choice of numeraire currency. While Lopez and Papell (2007) take into account heterogeneous intercepts and serial correlation in their panel tests, they keep the restriction that the speed of mean reversion is the same for all real exchange rates in the panel. Their tests thus do not provide information on which particular bilateral real exchange rates are stationary, nor on for which country pairs PPP holds. The rejection of nonstationarity in their panel study may result from the stationarity of only a few but not all real exchange rates, i.e., aggregation bias.

Besides Lopez and Papell (2007), other studies study the sensitivity of inferences to using different currencies as numeraire. For example, Papell and Theodoridis (2001) test the PPP hypothesis during the flexible exchange rates period by conducting panel unit root tests with twenty-one different base currencies. Their results suggest that the selection of numeraire currency is critical for inferences on PPP. They find that PPP holds better for European than for non-European base currencies.

2.3: Limitations/Motivation for Further Studies

From the literature reviewed, it is observed that the views and empirical findings of different economists vary overtime. For a more acceptable and consensus result, further studies need to be carried out for different economies with different

economic conditions. However, more studies need to be carried for Africa and other Less Developed Countries.

Furthermore, we understand that PPP is more likely to hold among countries with the same consumption pattern and inflation trend (Rogoff, 1996). Therefore, spreading of sample area across region(s) by previous researchers posed the risk of capturing different consumption patterns and inflationary trends.

Finally, literature tells us that the validity of LOOP and PPP assume that there exists competitive market structure and absence of tariff as well as non-tariff barriers to trade. Contrary to this assumption, previous studies were carried out among countries of different economic unions. There are so many trade frictions and other barriers to trade between these countries. As a result, there arises a need to carry out a study on two major member countries of the Economic Community Of West African States (ECOWAS).

These limitations of previous studies form a hub around which the present study revolves.

CHAPTER THREE

3.0 METHODOLOGY AND DATA

3.1: The Model

The law of one price which states that, measured in a common currency, freely traded identical commodities should have the same price everywhere in the absence of transaction and transportation costs is given by:

$$CPI_{it} = E_{it} + CPIFC_t \quad \ldots\ldots(1)$$

or in log form as:

$$P_{it} = Q_{it} + PFC_t \quad \ldots\ldots(1^*)$$

where

E_{it} = Nominal exchange rate of domestic country at time, t

$CPIFC_t$ = Consumer price index of foreign country (USA) at time, t

CPI_{it} = Domestic price index of country i at time, t.

Q_{it}, PFC_t and P_{it} are the logarithms of the above-defined variables respectively. Rearranging (1*) gives the absolute PPP (APPP) hypothesis. APPP simply states that a specific amount of any given currency should be able to purchase the same goods anywhere in the world. That is, currency adjusted price levels are equal. This form of PPP is written as:

$$Q_{it} = P_{it} - PFC_t \quad \ldots\ldots(2)$$

But the lack of absolute price level data constructed for internationally standardized baskets of goods to test the absolute PPP for almost any country and its inability to capture the inflation differentials between countries often enforces researchers to retreat to the testing of relative PPP (Rogoff 1996). RPPP suggests that over some time periods, any change in the exchange rate is precisely offset by the difference in the inflation rates of the two countries (Taylor and Taylor, 2004). RPPP would simply be written as:

$$\Delta Q_{it} = \Delta P_{it} - \Delta PFC_t \quad \text{.....(3)}$$

where Δ is the first difference operator. Other variables are as defined under (1*)

The empirical analog of (3) is

$$Q_{it} = \alpha + \beta P^*_{it} + \mu_{it} \quad \text{.....(4)}$$

where

$$Q_{it} = \left[\frac{E_{it} - E_{it-1}}{E_{it-1}}\right]$$

is the percentage change in nominal exchange rate of Domestic country

$$P^*_{it} = \left[\frac{CPI_{it}/CPIFC_t - CPI_{it-1}/CPIFC_{t-1}}{CPI_{it-1}/CPIFC_{t-1}}\right]$$

is the inflation differential between domestic and foreign countries.

μ_{it} is the stochastic error term at time, t.

i denotes country and t denotes year.

3.2: Model Justification

The model of purchasing power parity comes in two forms. One is based on a strict interpretation of the LOOP and is termed APPP as stated above. Its model is shown in equation (2) above. As stated earlier, this form of PPP is unlikely to hold precisely because of the existence of transportation costs, imperfect information and the distorting effects of tariffs and protection. Hence, the relative version of PPP (equation (3)), which is expected to hold even in the presence of such distortions, is preferred (Pilbeam, 1992). Using this model, PPP theory argues that the exchange rate will adjust by the amount of the inflation differential between the two economies.

Following Pilbeam (1992), Brook and Hargreaves (2001), MacDonnell (2005) and other previous studies, the researcher adheres to the relative PPP model.

3.3: Estimation Procedure

Objectives one and two will be achieved by estimating equation (4) using the Ordinary Least Square (OLS) technique for each of the study countries. The choice of OLS is due to its popularity in estimating time series econometric models. Also, the parameter estimates have the BLUE property. Here, the coefficient of interest is β. A finding that β is statistically indistinguishable from unity constitutes confirmation of PPP (technically speaking, RPPP since the equation is estimated in first difference of logs). On the other hand, if β is statistically different from one, RPPP will be rejected. Moreover, a unit root test will be conducted to test the stationarity of the real exchange rate.

Objective three will be achieved by comparing the value of β estimates for Nigeria and Ghana. A better economy is the one that has the greater value of the parameter, β.

3.4: Unit Root Test

In this study, we employ the Augmented Dickey Fuller (ADF) unit root test on bilateral real exchange rates of each country vis-à-vis the USA. PPP can be accepted only by rejecting the unit root hypothesis. This is because, even if the LOOP does not hold, PPP will be valid if the real exchange rate follows a mean reverting process. In other words, deviations from PPP equilibrium must be only transitory. This is confirmed by establishing the stationary nature of the real exchange rate. Equation (5) expresses the model for ADF test (Dickey- Fuller, 1981), when both a trend and a constant are included.

$$\Delta Q_{it} = \alpha_i + \beta_i Q_{it-1} + \sum_{j=1}^{p_{it}} \psi_{ij} \Delta Q_{it=1} + \phi_t \quad \text{.....(5)}$$

where Q_{it} is the log of the real exchange rate.

$$\Delta Q_{it-1} = (Q_{it-1} - Q_{it-2}), \Delta Q_{it=2} = (Q_{it-2} - Q_{it-3}) etc$$

βi is the mean reversion parameters, αi is the intercept parameters, ψ_{ij} is the coefficients on the lagged real exchange rate returns, p_{it} denotes the number of lags needed for currency *i*, and ϕ_{it} is a stationary error term.

The null hypothesis therefore, is that the real exchange rate has a unit root. Keeping in view the sensitivity of the unit-root test to lag selection, lag selection (value of p_{it}) will

be determined by the Akaike Information Criteria and Schwarz Criteria, and disputes in optimal lag selection will be resolved by Likelihood Ratio Test.

3.5: Data

The nominal exchange rates are annual bilateral U.S dollar exchange rates. The all items annual averages of CPIs are used as proxies for measuring the price levels of each country's output. In all cases, the United States dollar is considered as the 'numeraire.'

All exchange rate data were obtained from the national accounts section of the United Nations Statistics Division. CPIs for Nigeria were extracted from the Central Bank of Nigeria (CBN) statistical bulletin (several years). CPIs for Ghana were obtained from the Ghana Statistical Service. While CPIs for U.S.A. were obtained direct from the US Bureau of Labor Statistics (BLS). All data series are annual and span the period from 1970 to 2005.

3.6: Target Econometric Software

The E-Views 3.1 shall be used for analysis.

CHAPTER FOUR

4.0: EMPIRICAL RESULT

4.1: Nigeria and the validity of PPP theory.

Table 4.1 contains estimates of equation 4 (for Nigeria). The slope, -0.182591 is the point estimate of β. The estimated non- heteroscedastic (Homoscedastic) standard error is also shown (see also Table 4.3). Also in the table are the R^2 of the regression, the t-statistic and the t-probability among others.

The result is not consistent with relative PPP in the sense that β is typically estimated to be very far from unity in economic and statistical terms. The β as shown above is essentially indistinguishable from the null hypothesis of $\beta \neq 1$. The time series estimate of equation 4 (for Nigeria) is shown as a histogram in figure 4 (see Appendix 2).

However, table 4.2(a) contains estimated results for equation 5 (for Nigeria), the equation that estimates the mean reversion in the Nigeria's exchange rate. The ADF unit root test for NIGEX has the critical values, -3.6 at 1%, and -2.9 at 5% and –2.6 at 10% levels of significance. In all cases, the ADF test statistic (-3.89) is greater in absolute term. We therefore reject the null hypothesis of the existence of unit root. The (b) panel of table 4.2 also shows a situation of rejection of unit root hypothesis for NIGINF. As a result, there is strong evidence of mean reversion in the exchange rate of the crude oil exporting country. Mean reversion in the exchange rate can be seen in figure 7 (Appendix 2), a graphical version of equation 5 (for Nigeria). This is a scatter plot of the change in the real exchange rate with an intercept. Since Nigeria's exchange rate and inflation differentials are stationary at the same order of integration, we

conclude that there is a long-run relationship between the two variables. Below are the estimated results.

Table 4.1: Modeling NIGEX by OLS

Dependent Variable: NIGEX

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.268609	0.134611	1.995448	0.0543
NIGINF	-0.182591	0.459687	-0.397206	0.6938
R-squared	0.004758	Mean dependent var		0.234059
Durbin-Watson stat	1.910720	Prob(F-statistic)		0.693773

Table 4.2(a): ADF unit root test for Nigeria's exchange rate.

ADF Test Statistic	-3.893754	1% Critical Value*	-3.6422
		5% Critical Value	-2.9527
		10% Critical Value	-2.6148

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

Table 4.2(b): ADF unit root test for Nigeria's inflation differential.

ADF Test Statistic	-3.787722	1% Critical Value*	-3.6422
		5% Critical Value	-2.9527
		10% Critical Value	-2.6148

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

Table 4.3: Heteroskedasticity test for Nigeria

White Heteroskedasticity Test:

F-statistic	0.363620	Probability	0.697991
Obs*R-squared	0.777744	Probability	0.677821

Note: See details of tables in Appendix 1

4.2: Ghana and the validity of PPP theory

Table 4.4 contains estimates of equation 4 (for Ghana). The slope, 0.160330 is the point estimate of β. The estimated non- heteroscedastic (Homoscedastic) standard error is also shown (see also Table 4.6). As in the case of Nigeria, the result invalidates relative PPP in the sense that β is typically estimated to be significantly different from unity. The β as shown above is essentially indistinguishable from the null hypothesis of $\beta \neq 1$. The time series estimate of equation 4 (For Ghana) is shown as a histogram in figure 15 (see Appendix 4).

However, table 4.5(a) contains estimated results for equation 5 (for Ghana), the equation that estimates the mean reversion in the Ghana's exchange rate. The ADF unit root test for GHANEX has the critical values, -3.6 at 1%, -2.9 at 5% and –2.6 at 10% levels of significance. In all cases, the ADF test statistic (-3.75) is greater in absolute term. We therefore reject the null hypothesis of the existence of unit root. The (b) panel of table 4.5 also shows a situation of rejection of unit root hypothesis for GHANINF. As a result, there is strong evidence of mean reversion in the Ghana's exchange rate. Mean reversion in the exchange rate can be seen in figure 18 (Appendix 4), a graphical version of equation 5 (for Ghana). This is a scatter plot of the changes in the real exchange rate with an intercept. Since the exchange rate and inflation differentials of the Nigeria's neighbouring country are stationary at the same order of integration, we also conclude that there is a long-run relationship between GHANEX and GHANINF.

Table 4.4: Modeling GHANEX by OLS

Dependent Variable: GHANEX

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.332977	0.108797	3.060531	0.0044
GHANINF	0.160330	0.104936	1.527886	0.1361
R-squared	0.066067	Mean dependent var		0.380233
Durbin-Watson stat	1.157227	Prob(F-statistic)		0.136070

Table 4.5(a): ADF unit root test for Ghana's exchange rate.

ADF Test Statistic	-3.754780	1% Critical Value*	-3.6422
		5% Critical Value	-2.9527
		10% Critical Value	-2.6148

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

Table 4.5(b): ADF unit root test for Ghana's inflation differential.

ADF Test Statistic	-5.278001	1% Critical Value*	-3.6422
		5% Critical Value	-2.9527
		10% Critical Value	-2.6148

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

Table 4.6: Heteroskedasticity test for Ghana

White Heteroskedasticity Test:

F-statistic	1.173480	Probability	0.322246
Obs*R-squared	2.391582	Probability	0.302465

Note: See details of tables in Appendix 3

4.3: Nigeria versus Ghana: Evidence from currency purchasing power.

It is important to note that the PPPs published by the International Monetary Fund and other international economic organisations are not for equilibrium exchange rates proxies. They are calculated to facilitate international comparisons of prices and volumes for GDP and its components. Purchasing power parities as equilibrium exchange rates have long existed in international trade theory. PPP theory predicts that in equilibrium, a dollar should buy the same basket of goods and services in all countries, as free trade causes prices in the various countries to converge. In the long run, then, the exchange rate between two countries should reflect the ratio of the price levels.

However, the **third objective** of this study is to compare the purchasing powers of Nigerian naira and that of Ghanaian cedi. This comparison is based on the β estimates of equation 4 for the two countries. Table 4.1 shows the β estimate of the said equation for Nigeria to be **–0.182591**. The same equation produced **0.160330** as the coefficient of GHANINF (β estimate for Ghana) (see table 4.4). It is observed that the parameter is higher in Ghana than in Nigeria. This shows that the purchasing power of Ghanaian Cedi is greater than that of Nigerian naira. We therefore conclude that Ghana is better than Nigeria in terms of the purchasing powers of their currencies.

NOTE:

1) **Q in equation 4(Chapter 3) is here used as NIGEX (For Nigeria) and GHANEX (For Ghana).**
2) **P* also in equation 4 is used as NIGINF (For Nigeria) and GHANINF (For Ghana)**

CHAPTER FIVE

5.0: CONCLUSION AND POLICY RECOMMENDATIONS

5.1: Conclusion

The PPP doctrine is an important assumption in most models in international economics. The theory of PPP throws light on some important factors, which affect the exchange rate movements. It has also been used as a basis for determining the exchange rate levels, and also in comparing GDP and its components across countries. This takes the researcher a step ahead to test its validity. The present study employed one of the latest techniques, the relative PPP equation to achieve its objectives one and two (testing the validity of PPP theory for Nigeria and Ghana, each bilaterally with the numeraire country, USA.). This study found the theory invalid in both countries. The ADF univariate unit root test was employed to test the mean reverting status of the exchange rates of the two countries. The exchange rates of these countries are found to be mean reverting.

However, contrary to expectations subject to the exchange rate values of the currencies of the two countries under study, this study found that Ghanaian Cedi has a higher purchasing power than Nigerian Naira. This is enough reason for us to conclude that exchange rate is highly deficient as a basis for comparing GDP and its components across boarders. Purchasing power parity should therefore be used as the more appropriate currency converter for such comparisons.

5.2: Policy Recommendation.

We have seen above that the choice of the set of international prices can lead to potentially vastly different PPP exchange rates and therefore different estimates of PPP GDPs and its components. Chapter four exposed the variation in the purchasing powers of Nigerian Naira and Ghanaian Cedi. This variation is undesired owning to the fact that the two countries are neighbours and belong to the same economic organisation (ECOWAS). However, countries that share these features in common are expected to have similar economic structures with limited or no tariff and non-tariff barriers to trade. The combination of these attributes is enough for economic variables such as currency purchasing power in both countries to move in the same direction. To facilitate the convergence of the purchasing powers of Naira and Cedi, we recommend the following:

1. The governments of Nigeria and Ghana should make and implement macroeconomic and structural policies that will converge along the same line as those of its partner.
2. Each of the two countries should embark on policies that aim at the elimination of tariff and non-tariff barriers to trade. This will enhance south-south trade, economic efficiency and growth, and also foster private sector development in both countries.
3. The monetary authorities in both countries should manage their respective real exchange rates and re-establish international competitiveness which will go a long way in reversing losses in their respective foreign exchange reserves.

4. To maintain international competitiveness and stabilize their economies, the governments of these countries should return to PPP-oriented rule as a basis for their exchange rate policies.
5. Economists and analysts comparing GDP and its components across boarders should base their comparisons on PPP estimates of the variable(s) under consideration. This will go a long way in yielding a more accurate result.

The researcher is therefore highly optimistic that if the above recommendations are taken into considerations by the two West African neighbors and member states of ECOWAS, the purchasing powers of their currencies as well as other economic variables will tend to converge to an equilibrium trend.

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APPENDIX 1

Table 4.1: Modeling NIGEX by OLS

Dependent Variable: NIGEX
Method: Least Squares
Date: 11/14/07 Time: 15:22
Sample: 1971 2005
Included observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.268609	0.134611	1.995448	0.0543
NIGINF	-0.182591	0.459687	-0.397206	0.6938
R-squared	0.004758	Mean dependent var		0.234059
Adjusted R-squared	-0.025401	S.D. dependent var		0.600201
S.E. of regression	0.607776	Akaike info criterion		1.897424
Sum squared resid	12.18992	Schwarz criterion		1.986301
Log likelihood	-31.20493	F-statistic		0.157773
Durbin-Watson stat	1.910720	Prob(F-statistic)		0.693773

Table 4.2(a): ADF unit root test for Nigeria's exchange rate.

ADF Test Statistic	-3.893754	1% Critical Value*	-3.6422
		5% Critical Value	-2.9527
		10% Critical Value	-2.6148

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(NIGEX)
Method: Least Squares
Date: 11/14/07 Time: 15:27
Sample(adjusted): 1973 2005
Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NIGEX(-1)	-0.984523	0.252847	-3.893754	0.0005
D(NIGEX(-1))	0.020470	0.182153	0.112377	0.9113
C	0.246772	0.126993	1.943198	0.0614
R-squared	0.483414	Mean dependent var		0.001968
Adjusted R-squared	0.448975	S.D. dependent var		0.854367
S.E. of regression	0.634206	Akaike info criterion		2.013622
Sum squared resid	12.06652	Schwarz criterion		2.149668
Log likelihood	-30.22477	F-statistic		14.03679
Durbin-Watson stat	2.003735	Prob(F-statistic)		0.000050

Table 4.2(b): ADF unit root test for Nigeria's inflation differential.

ADF Test Statistic	-3.787722	1% Critical Value*	-3.6422
		5% Critical Value	-2.9527
		10% Critical Value	-2.6148

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(NIGINF)
Method: Least Squares
Date: 11/14/07 Time: 15:35
Sample(adjusted): 1973 2005
Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NIGINF(-1)	-0.791546	0.208977	-3.787722	0.0007
D(NIGINF(-1))	0.153050	0.178899	0.855513	0.3990
C	0.156749	0.056159	2.791184	0.0090

R-squared	0.363624	Mean dependent var	0.003360
Adjusted R-squared	0.321199	S.D. dependent var	0.271262
S.E. of regression	0.223491	Akaike info criterion	-0.072381
Sum squared resid	1.498450	Schwarz criterion	0.063665
Log likelihood	4.194289	F-statistic	8.570988
Durbin-Watson stat	2.027093	Prob(F-statistic)	0.001137

Table 4.3: Heteroskedasticity test for Nigeria

White Heteroskedasticity Test:

F-statistic	0.363620	Probability	0.697991
Obs*R-squared	0.777744	Probability	0.677821

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/14/07 Time: 15:51
Sample: 1971 2005
Included observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.597318	0.398771	1.497899	0.1440
NIGINF	-2.019202	3.162510	-0.638481	0.5277
NIGINF^2	1.551527	3.952178	0.392575	0.6972

R-squared	0.022221	Mean dependent var	0.348284
Adjusted R-squared	-0.038890	S.D. dependent var	1.474723
S.E. of regression	1.503125	Akaike info criterion	3.734786
Sum squared resid	72.30031	Schwarz criterion	3.868102
Log likelihood	-62.35875	F-statistic	0.363620
Durbin-Watson stat	2.103299	Prob(F-statistic)	0.697991

APPENDIX 2

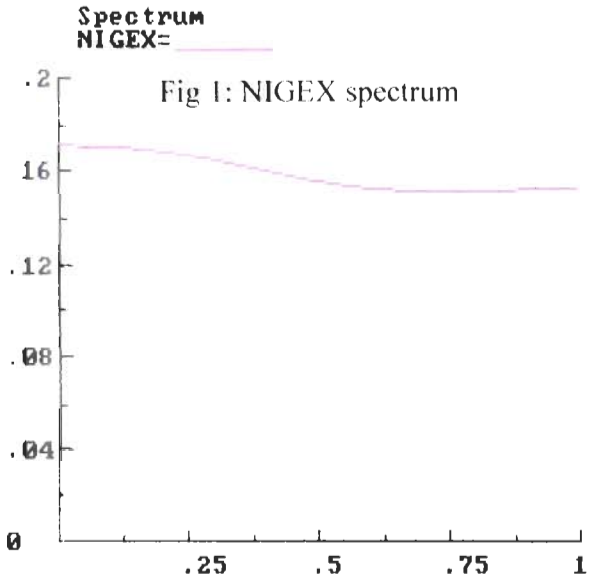


Fig 1: NIGEX spectrum

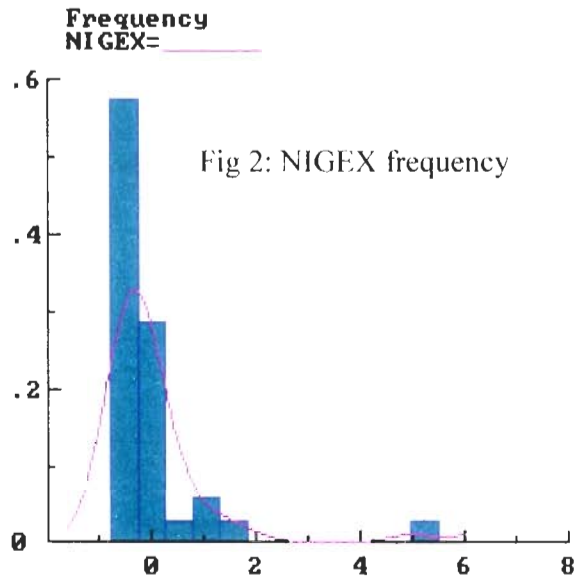


Fig 2: NIGEX frequency

Fig 3:

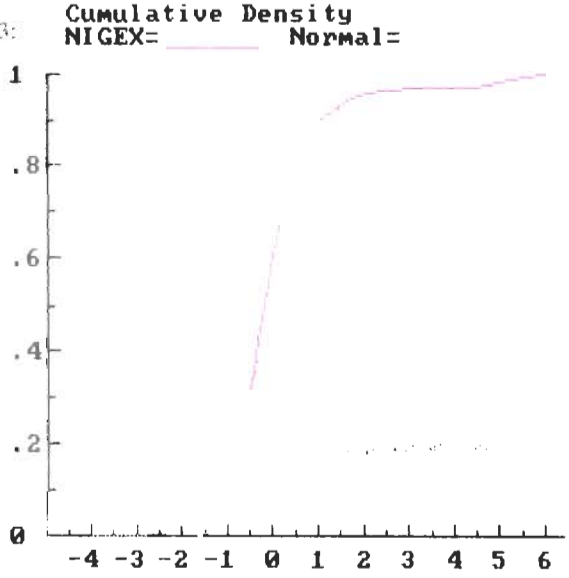
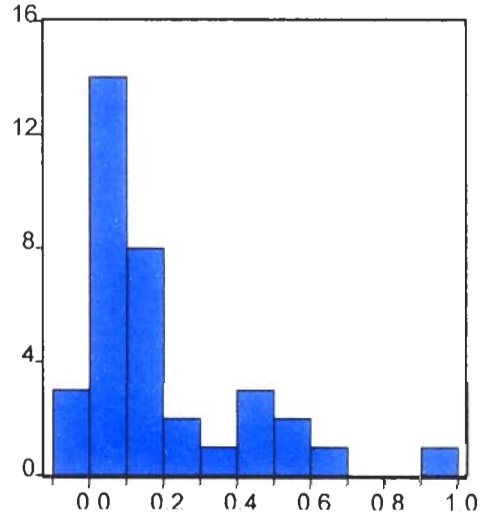
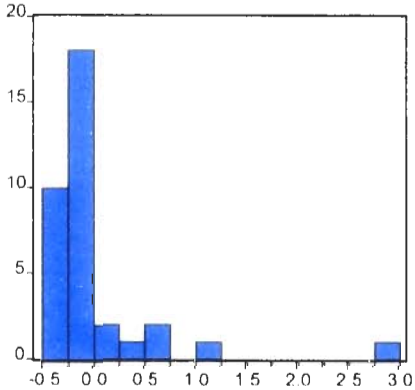


Fig 4: NIGINF frequency



Series: NIGINF
Sample 1971 2005
Observations 35

Mean	0.189223
Median	0.110235
Maximum	0.961550
Minimum	-0.029680
Std. Dev.	0.226747
Skewness	1.647794
Kurtosis	5.371993
Jarque-Bera	24.04391
Probability	0.000006



Series: Residuals
Sample 1971 2005
Observations 35

Mean	-7.14E-17
Median	-0.174783
Maximum	2.958267
Minimum	-0.369219
Std. Dev.	0.598771
Skewness	3.784157
Kurtosis	18.41669
Jarque-Bera	430.1409
Probability	0.000000

Fig 6: NIGEX=
Fitted=

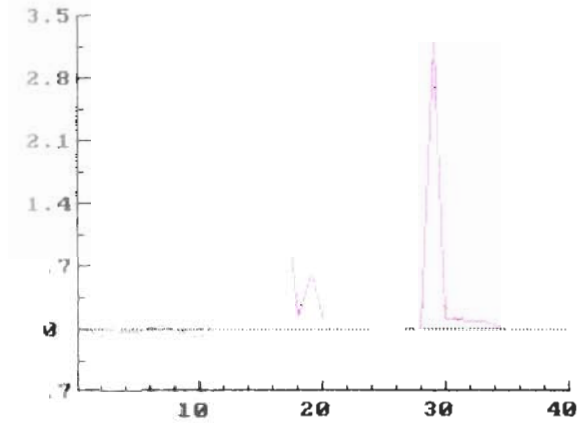
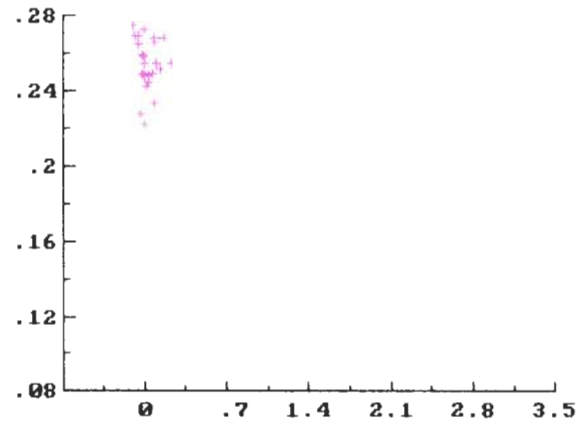


Fig 7: Fitted NIGEX Cross-plot
Sample is 1 to 35



Residual=

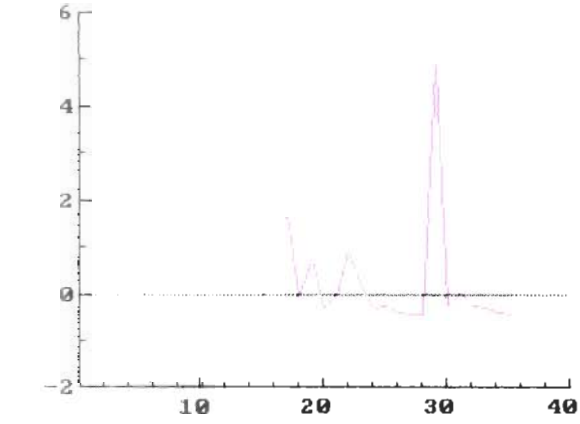
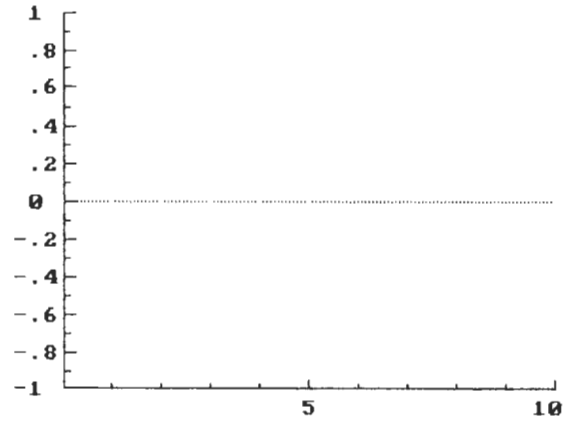


Fig 9: Correlogram
NIGEX=



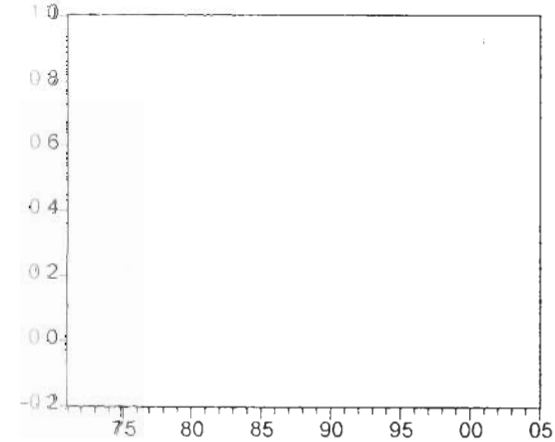


Fig 10: NIGEX

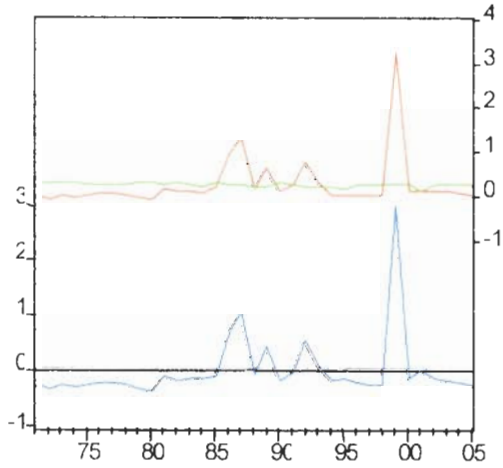


Fig 11: Residual Actua Fitted

APPENDIX 3

Table 4.4: Modeling GHANEX by OLS

Dependent Variable: GHANEX
Method: Least Squares
Date: 11/22/07 Time: 17:34
Sample: 1971 2005
Included observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.332977	0.108797	3.060531	0.0044
GHANINF	0.160330	0.104936	1.527886	0.1361
R-squared	0.066067	Mean dependent var		0.380233
Adjusted R-squared	0.037766	S.D. dependent var		0.629088
S.E. of regression	0.617095	Akaike info criterion		1.927857
Sum squared resid	12.56660	Schwarz criterion		2.016735
Log likelihood	-31.73751	F-statistic		2.334435
Durbin-Watson stat	1.157227	Prob(F-statistic)		0.136070

Table 4.5(a): ADF unit root test for Ghana's exchange rate.

ADF Test Statistic	-3.754780	1% Critical Value*	-3.6422
		5% Critical Value	-2.9527
		10% Critical Value	-2.6148

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GHANEX)
Method: Least Squares
Date: 11/22/07 Time: 17:36
Sample(adjusted): 1973 2005
Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GHANEX(-1)	-0.703232	0.187290	-3.754780	0.0007
D(GHANEX(-1))	0.263230	0.176444	1.491864	0.1462
C	0.274437	0.125452	2.187580	0.0366
R-squared	0.324994	Mean dependent var		-0.008503
Adjusted R-squared	0.279994	S.D. dependent var		0.679112
S.E. of regression	0.576248	Akaike info criterion		1.821950
Sum squared resid	9.961842	Schwarz criterion		1.957996
Log likelihood	-27.06217	F-statistic		7.222037
Durbin-Watson stat	1.865229	Prob(F-statistic)		0.002752

Table 4.5(b): ADF unit root test for Ghana's inflation differential.

ADF Test Statistic	-5.278001	1% Critical Value*	-3.6422
		5% Critical Value	-2.9527
		10% Critical Value	-2.6148

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GHANINF)
Method: Least Squares
Date: 11/22/07 Time: 17:45
Sample(adjusted): 1973 2005
Included observations: 33 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GHANINF(-1)	-1.529653	0.289817	-5.278001	0.0000
D(GHANINF(-1))	0.148588	0.174259	0.852688	0.4006
C	0.393644	0.185952	2.116917	0.0427
R-squared	0.673000	Mean dependent var		0.002570
Adjusted R-squared	0.651200	S.D. dependent var		1.617355
S.E. of regression	0.955199	Akaike info criterion		2.832714
Sum squared resid	27.37216	Schwarz criterion		2.968760
Log likelihood	-43.73978	F-statistic		30.87151
Durbin-Watson stat	2.010723	Prob(F-statistic)		0.000000

Table 4.6: Heteroskedasticity test for Ghana

White Heteroskedasticity Test:

F-statistic	1.173480	Probability	0.322246
Obs*R-squared	2.391582	Probability	0.302465

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/22/07 Time: 18:01
Sample: 1971 2005
Included observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.306905	0.244716	1.254124	0.2189
GHANINF	-0.524201	0.398039	-1.316958	0.1972
GHANINF^2	0.192239	0.125977	1.525978	0.1368
R-squared	0.068331	Mean dependent var		0.359046
Adjusted R-squared	0.010102	S.D. dependent var		1.376083
S.E. of regression	1.369115	Akaike info criterion		3.548022
Sum squared resid	59.98320	Schwarz criterion		3.681338
Log likelihood	-59.09039	F-statistic		1.173480
Durbin-Watson stat	2.201617	Prob(F-statistic)		0.322246

APPENDIX 4

Fig 12: Spectrum GHANEX=

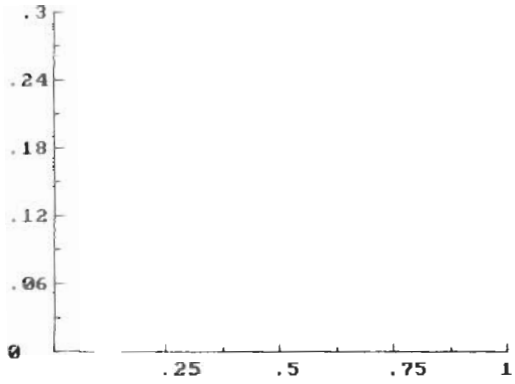


Fig 13: Frequency GHANEX=

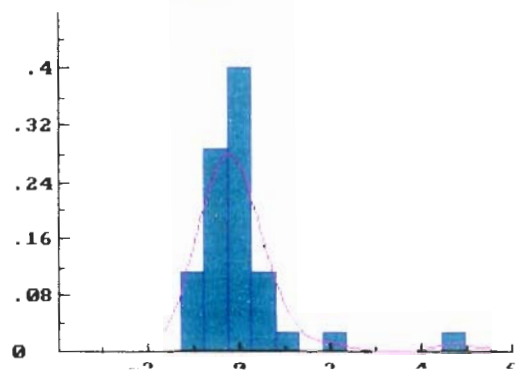
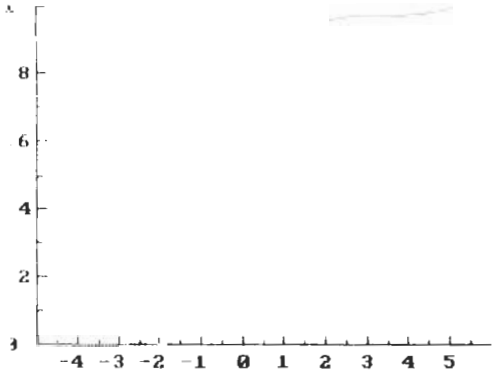
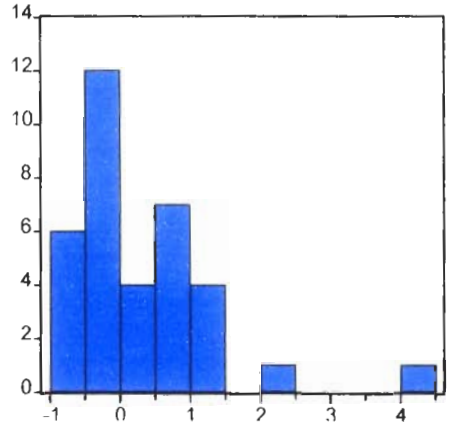


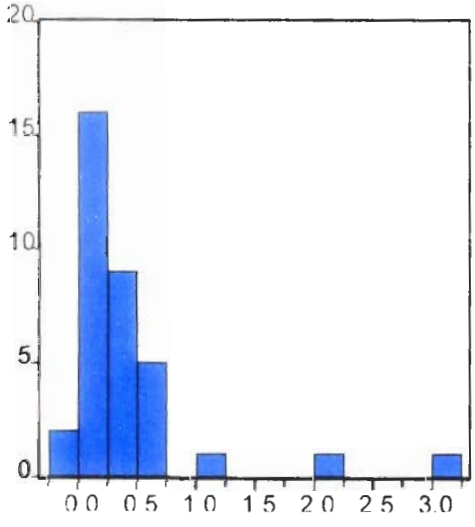
Fig 14: Cumulative Density GHANEX= Normal=





Series: GHANINF	
Sample 1971 2005	
Observations 35	
Mean	0.294742
Median	-0.028482
Maximum	4.334680
Minimum	-0.819610
Std. Dev.	1.008528
Skewness	1.985159
Kurtosis	8.397484
Jarque-Bera	65.47371
Probability	0.000000

Fig 15: GHANINF Frequency



Series: GHANEX	
Sample 1971 2005	
Observations 35	
Mean	0.380233
Median	0.208640
Maximum	3.075440
Minimum	-0.126290
Std. Dev.	0.629088
Skewness	3.033742
Kurtosis	12.46984
Jarque-Bera	184.4678
Probability	0.000000

Fig 16: GHANEX Frequency

Fig 17: GHANEX=
Fitted=

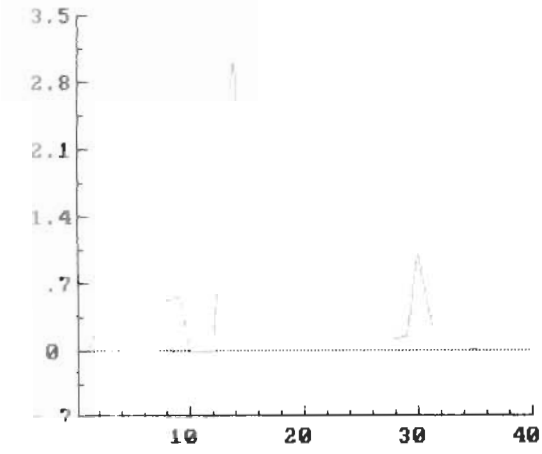
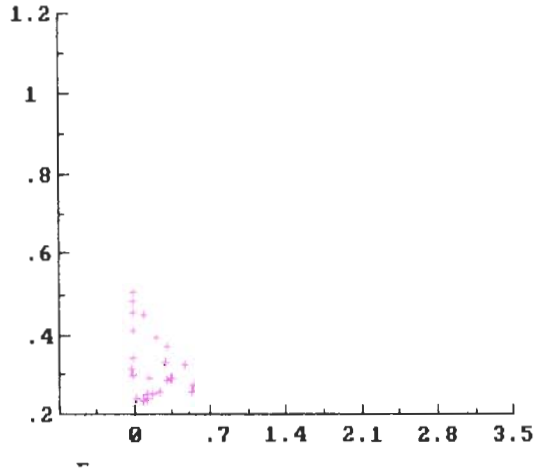


Fig 18: Fitted GHANEX Cross-plot
Sample is 1 to 35



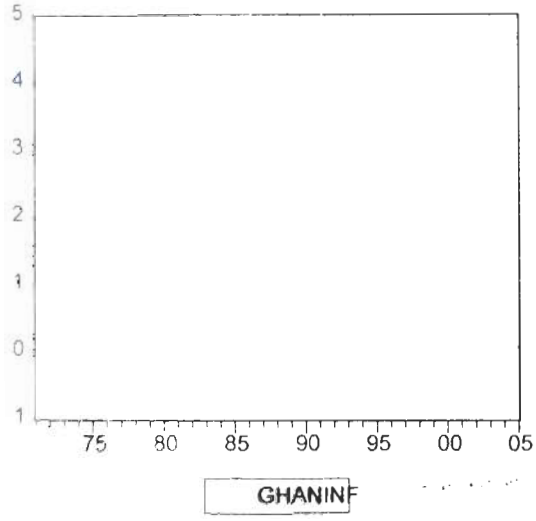


Fig 19: GHANINF Residuals

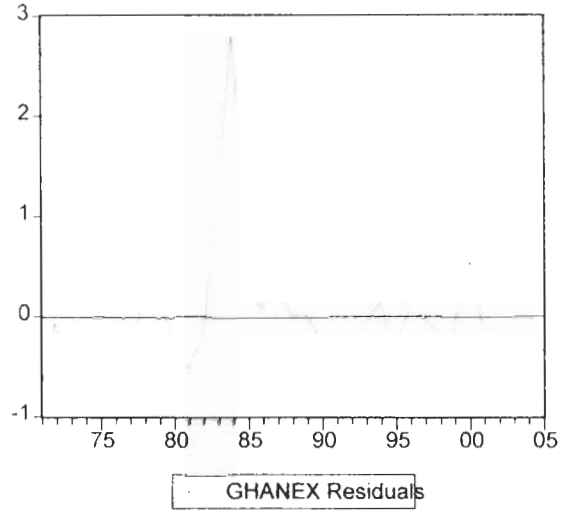


Fig 20: GHANEX Residuals

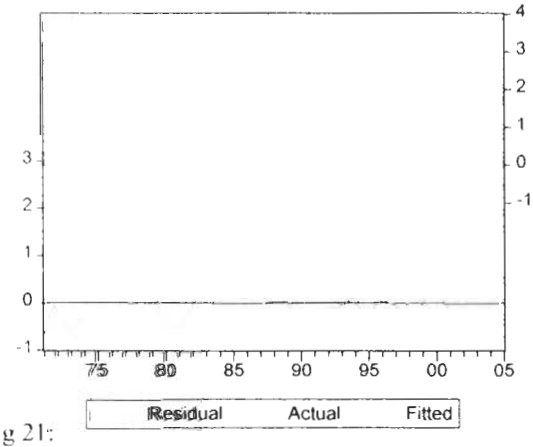


Fig 21: