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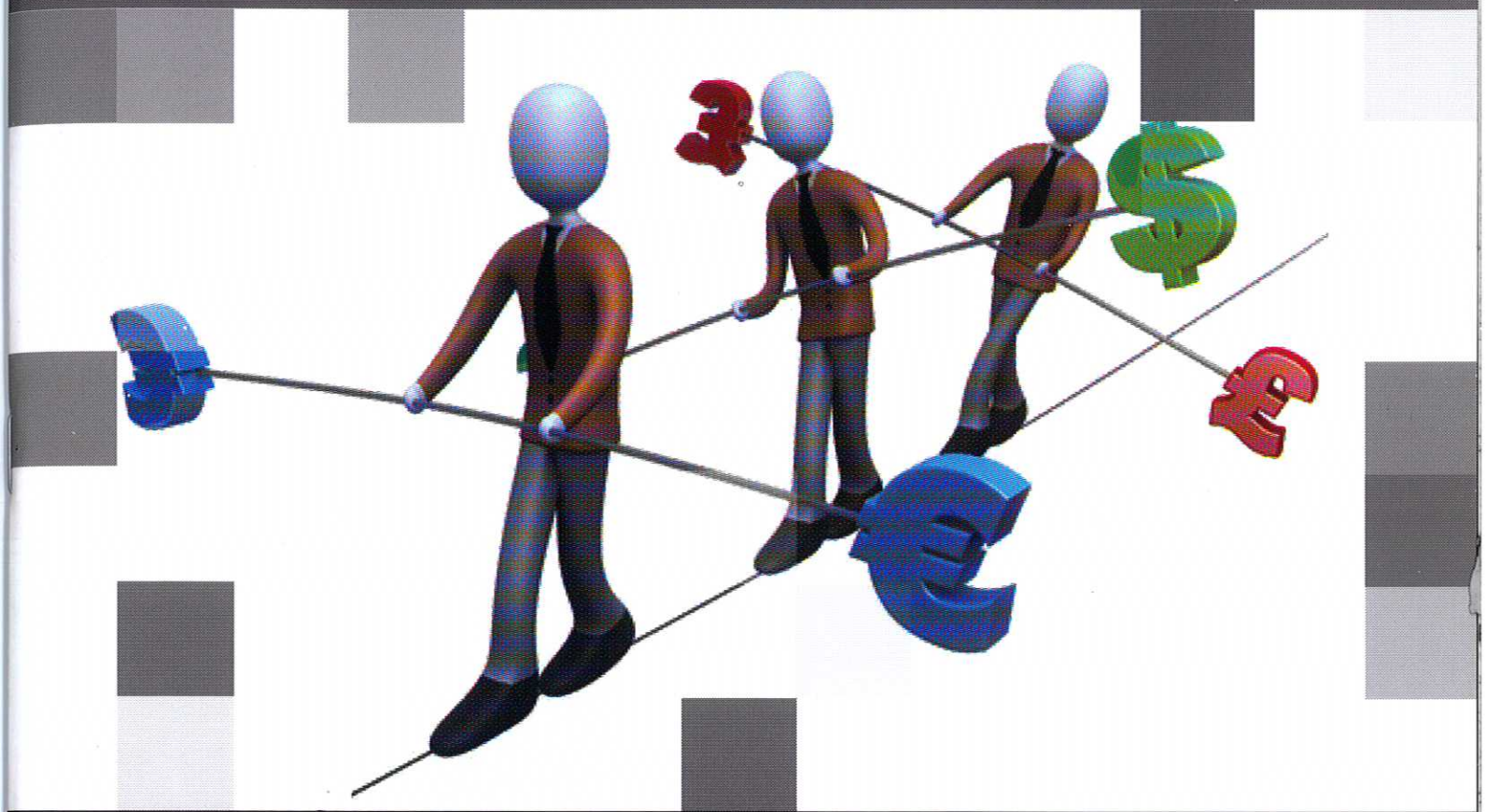

DETERMINATION OF REAL EXCHANGE RATE MISALIGNMENT FOR GHANA

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INSTITUTE OF ECONOMIC AFFAIRS, GHANA

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DETERMINATION OF REAL EXCHANGE RATE MISALIGNMENT FOR GHANA

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Abstract

The paper determines real exchange rate misalignment for Ghana for the period 1980-2010. It finds that the equilibrium real exchange rate is influenced to a significant extent by "fundamental" or "real" factors—represented in the study by productivity, trade openness, real relative interest rate, government expenditure, terms-of-trade and foreign reserves. Nominal macroeconomic variables—represented by domestic credit and the budget deficit—however, do not have a significant effect on the ERER. The actual real exchange rate is misaligned relative to the equilibrium value either way—i.e. overvaluation or undervaluation—throughout the study period. The results indicate strong real overvaluation during 1981- 83, and moderate overvaluation or undervaluation for other sub-periods. The real exchange rate adjusts rapidly to the equilibrium level, with about 97% of any misalignment being corrected within a year. Tentative inference from exchange rate data available from Bank of Ghana suggests that during January 2011- June 2012, contrary to expectation of possible real undervaluation following the nominal depreciation of about 20%, the real exchange rate was only restored to its equilibrium level and by end-June 2012 there was no significant misalignment either way.

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ABOUT US

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Executive Summary

Ghana adopted an independent currency and monetary policy from the time of independence in 1957. After operating with a fixed-type exchange rate regime for a considerable length of time, a more flexible regime was adopted in 1983, which has more or less been kept in place. Over the years, the currency, which has been changed several times, depreciated almost incessantly against foreign currencies. This fueled inflation, eroded national income, and undermined confidence in the economy. Depreciation is driven in part by short-term demand and supply shocks, some seasonal in nature. But the long-term trend depreciation reflects more fundamental factors; in particular macroeconomic instability, low productivity and lack of sustained economic growth.

The objective of the paper is to determine the equilibrium real exchange rate and real misalignment for Ghana. This objective derives from the fact that despite the continued depreciation of the exchange rate, the extent of misalignment relative to the equilibrium level may not be known. Like other prices, however, exchange rate misalignment can cause distortions in the economy, including poor performance of exports, surge in imports, adverse movements in the capital account, and sub-optimal domestic output. Misalignment can also precipitate inflation and debt crisis; it may breed rent-seeking and protectionism. In general, exchange rate misalignment can jeopardize the competitiveness or overall performance of the economy. Determination of exchange rate misalignment is important for guiding policy towards improving the economy's competitiveness and overall performance.

The paper estimates the equilibrium real exchange rate (ERER) for Ghana for the period 1980-2010, using the behavioral equilibrium approach. In line with this approach, a model is specified for the ERER in terms of "fundamental" or "real" determinants. These determinants are represented in this study by productivity, trade openness, real relative interest rate, government expenditure, terms-of-trade and foreign reserves. In addition to the real variables, the literature also recognizes the effect of some nominal macroeconomic variables on the ERER. In this study, the macroeconomic variables are represented by domestic credit and the budget deficit. Together, the real and nominal variables influence the ERER in the short run and in the long run. The error correction model (ECM) methodology is used for the estimation to capture both the long-run effects and short-run dynamics. By its nature, the ERER is not directly observable or measurable. The literature however links the measurable actual real exchange rate (ARER) to the unobservable ERER. Using this link, an equation is specified relating the ARER, represented by the real effective exchange rate (REER), to the determinants of the ERER.

The results indicate a strong long–run and short-run relationship between the REER and the determinants for the study period. Productivity has both long-run and short-run impact on the real exchange rate. All the other variables (openness, real relative interest rate, government

expenditure, terms-of-trade, foreign reserves, domestic credit, and the budget deficit) have short-run impact on the real exchange rate.

In terms of direction of impact, productivity has a significant positive (appreciating) impact on the real exchange rate in the long run, supporting the theory that an increase in productivity raises the relative wage, which is spent mostly on, and increases the relative price of, nontradables. In the short-run, however, productivity has a significant negative (depreciating) impact on the real exchange rate, consistent with the alternative theory that higher productivity could cause the relative price of tradables to fall. Trade openness has a significant negative (depreciating) impact on the real exchange rate, consistent with the theory that more trade openness increases demand for imports and reduces relative demand for nontradables, which causes a fall in the relative price of nontradables, and a worsening of the current account. Real relative interest rate has a significant negative (depreciating) impact on the real exchange rate, in line with the theory that higher demand resulting from capital inflow that emanates from an increase in the real relative interest rate is directed mostly at tradables. Total government expenditure has a significant positive (appreciating) impact on the real exchange rate, supporting the theory that it is mostly directed toward nontradables. The terms-of-trade has a significant positive (appreciating) impact on the real exchange rate, consistent with the theory that improvement in the terms of trade increases national "wealth" that leads to higher domestic demand directed at nontradables. Foreign reserves have a significant negative (depreciating) impact on the real exchange rate, in line with the theory that an increase boosts demand that is directed mostly at tradables.

Domestic credit has a positive (appreciating) impact on the real exchange rate, in line with the theory that domestic credit expansion increases domestic demand that is directed mostly toward nontradables. The effect, however, is not significant. The fiscal deficit also has a positive (appreciating) impact on the real exchange rate in line with preponderance of the literature. However, the impact is not significant.

The ERER, derived as the permanent component of the estimated REER, follows a declining path for the study period. This implies that the combined effect of the fundamental factors pulling it down, i.e. causing it to depreciate, outweighs the effect of those pulling it up, i.e. causing it to appreciate. This also indicates that there is constant downward pressure on the actual real exchange rate (REER). This is because any deviation of REER from ERER must be corrected over time. The speed of adjustment of REER to the ERER is found to be (-)0.97, implying that 97% of any misalignment is corrected within a year. This is a relatively fast pace of adjustment that is consistent with other findings for Ghana.

The results show clear evidence of misalignment one way or the other—i.e. overvaluation or undervaluation—throughout the study period. Apart from 1981-83, when overvaluation is strongly indicated, the rest of the period does not indicate any significant bias towards overvaluation or undervaluation.

Starting from a position of undervaluation in 1980, the real exchange rate became strongly overvalued during1981-83 vis-à-vis its equilibrium level. This was a period when the fixed nominal exchange rate was grossly overvalued in the face of high inflation, general macroeconomic instability, and severe economic distortions. Starting from 1983, extensive steps

were taken to liberalize the economy and to improve its overall performance. These corrective measures eliminated the previous overvaluation and led to undervaluation during 1984-90. For the rest of the period, 1991-2010, various policy measures led to bouts of stability and instability, which affected the direction and degree of misalignment. On the whole, overvaluation is found for 1981-83, 1991-92, 1996-99, 2005-08, and 2010; and undervaluation for 1980, 1984-90, 1993-95, 200-2004, and 2009.

The available data allowed the exchange rate misalignment to be determined up to 2010. Beyond that date, tentative inferences are made using available exchange rate data from Bank of Ghana. The data indicates that from January 2011 to June 2012, the bilateral dollar-cedi nominal rate depreciated by about 20%. However, the (trade-weighted) real effective exchange rate depreciated by only 2%. This suggests that nearly 18% of the nominal depreciation accounted for inflation differential with Ghana's trading partners. The IEA study found "real overvaluation" of about 1.6% as of end 2010. Therefore, the 2% real depreciation that occurred during January 2011-June 2012 just about erased the real overvaluation existing as of end 2010. Further, assuming all things equal, and in particular that the equilibrium real exchange rate does not change between end-2010 and June 2012, it can be deduced that contrary to expectation of possible real undervaluation, the large nominal depreciation that occurred during the period restored the real exchange rate to its equilibrium level and that by June 2012, there was no significant misalignment one way or the other.

Following from the determination that the long-run decline of the Ghanaian cedi is influenced by economic fundamentals (that consistently drive the real rate towards its equilibrium level) to stem the tide of depreciation, policy strategy must focus on strengthening the economy's fundamentals, with sustained macroeconomic stability and growth being at the core. The IEA has articulated such corrective policy measures in other papers.[2]

[2] 1. IEA Legislative Alert, vol. 10, No. 7, June/July 2012: The recent slide in the cedi should be a wake-up call. (by Dr. J. K. Kwakye).
2. IEA Legislative Alert, vol 19, No. 8, 1 June, 2012, The perils of a "Guggisberg economy." (by Dr. J. K. Kwakye).

CONTENTS

1. Introduction

Ghana adopted an independent currency and monetary policy from the time of independence in 1957. After operating with a fixed-type of exchange regime for a long time, a more flexible regime was adopted in 1983 and has more or less been kept in place till today. Over the years, the currency, which has been changed several times, depreciated incessantly against foreign currencies. This fueled inflation, eroded national income, and undermined confidence in the economy.

The exchange rate is affected from time to time by temporary demand and supply shocks, some seasonal in nature. The long-term depreciation, however, reflects more fundamental factors. Past studies, including some undertaken by the IEA, focused largely on identifying the causes of the depreciation. Not much work has however been done on determining the equilibrium path for the exchange rate. Such determination is important in unraveling any misalignment, i.e. overvaluation or undervaluation. Like other prices, exchange rate misalignment can cause distortions in the economy, including poor performance of exports, undesirable levels of imports, adverse movements in the capital account and sub-optimal domestic output. Misalignment can also precipitate inflation and debt crisis. It may also breed rent-seeking and protectionism. In general, exchange rate misalignment can jeopardize competitiveness and the overall performance of the economy.

This study focuses on determining the "equilibrium path" for the real exchange rate for the period 1980-2010. By establishing to what extent the actual real exchange rate has been tracking its equilibrium path, the degree of "misalignment" is ascertained.

The paper is structured as follows. Following this introduction, the history of Ghana's currency and exchange rate is presented in Chapter 2. This is followed in Chapter 3 with a discussion of some definitional concepts and a review of the literature. In Chapter 4, a model is specified to determine the equilibrium path for the real exchange rate for the review period. The model estimation results and analysis are presented in Chapter 5. Chapter 6 concludes the paper.

[3] The first paper issued in January 2012, was titled: Ghana's Middle Income Reality Check Part I: The Economic Dimension.
[4] The first paper used largely economic indicators to assess Ghana's MIC status, with Malaysia and South Africa as comparator MICs.

2. History of Ghana's currency and exchange rate

From independence in 1957 to 1965, Ghana's currency was the Ghana pound, which exchanged at par with the British pound. In 1965, a new currency, the "cedi," which will be referred to here as the "first cedi" for purposes of distinguishing it from subsequent currencies, was introduced to replace the previous currency, at a rate of 2.4 cedis = 1 Ghana pound. The cedi was pegged to the British pound, also at a rate of 2.4 cedis = 1 British pound.

In 1967, the first cedi was replaced by the "second cedi," named 'new cedi,' and defined to be worth 1.2 times the first cedi. This change also allowed a decimal conversion with the previous Ghana pound, i.e. 2 second cedis = 1 Ghana pound. The 'second cedi' was initially pegged to the British pound at a rate of 2 cedis = 1 British pound. However, within months, the second cedi was devalued to a rate of 2.45 cedis = 1 British pound. In terms of the US dollar, which later replaced the pound as the intermediary/intervention currency, this rate was equivalent to 1 cedi = 0.98 US dollars. The rate to the dollar was maintained even when the British pound was devalued in November 1967. The cedi was subsequently devalued to $0.55 in 1971 and then revalued to $0.78 in 1972 and again to $0.8696 in 1973 before the currency was "floated" in 1978. High inflation ensued, eroding the value of the cedi, which was re-pegged at a much-depreciated value of 2.75 cedis = $1.00.

Inflation continued to erode the cedi's value. By 1983, the cedi was worth about 80-120 to one US dollars on the black market, although the official rate continued to be 2.75 cedis = $1.00. Finally, with the economy facing serious difficulties, including foreign currency shortages, the government began a process of gradual devaluation of the currency accompanied by other economic liberalization measures. These policies were implemented in the context of an Economic Recovery Program (ERP) sponsored by the IMF and the World Bank to restore the health of the economy. The gradual devaluations culminated in a "free float" of the cedi in 1990. Under this regime, the value of the cedi was determined in the interbank foreign exchange market. The central bank has however maintained a presence in the market to provide foreign exchange to meet part of the demand. Through this channel, the bank is in a position to influence the exchange rate. The exchange system is thus best characterized as a managed- rather than independent-float.

In July 2007, a "third cedi" was introduced, worth 10,000 "second cedis." The external purchasing power of the currency was, however, maintained. This implied neither a devaluation nor re-valuation—only a redenomination. Because of this change, Ghana's currency became one of the highest-valued currency units from one of the least valued. The exchange rate at the time of the redenomination was 9,200 second cedis = 1 US dollar. Therefore, in terms of third cedis, the rate became 0.92 third cedis = 1 US dollar. Since the redenomination, the cedi has continued to depreciate, largely in line with inflation differential. By August 2012, the cedi had depreciated to 1.89 cedis=1 US dollar (See Table 1).

Table 1: Historical evolution of the U.S. dollar- Ghana cedi exchange rate

Period	Cedis per US$	Period	Cedis per US$
First cedi			
1965	0.824	1967	0.714
Second cedi			
1970-79	0.833-1.111	1980	2.75
1983	2.75-30.00	1984	35-50
1985	50 – 60	1986	90
1987	150 – 175	1988	175 – 230
1989	230 – 300	1990	300 – 345
1991	345 – 390	1992	390 – 520
1993	555 – 825	1994	825 – 1050
1995	1050 – 1450	1996	1450 – 1750
1997	1750 – 2250	1998	2250 – 2350
1999	2350 – 3550	2000	3550 – 6750
2001	6750 – 7300	2002	7300 – 8450
2003	8450 – 8850	2004	8850 – 8900
2005	8900 – 9500	2006	9500 – 9600
2007	9600 – 9300		
Third cedi			
2007	0.92 (July)	2008	1.21(Dec)
2009	1.42 (Dec)	2010	1.45 (Dec)
2011	1.55(Dec)	2012	1.89 (Aug)

3. Definitional concepts and literature review

Historically, money replaced barter, which entailed exchange of goods for goods, for trading between peoples and nations. The use of money was generally convenient—and made life easier. The first hurdle to clear in order to use money or currency for trade between nations was to define (bilateral) rates of exchange between any two currencies. This was initially settled with each country indicating the intrinsic value of its then-gold-based currency in terms of the gold content. This was used to determine initial exchange rates between the various currencies. As paper money replaced metallic money however, this idea of intrinsic value became only notional as the intrinsic value of paper money is small. Over the years, currency devaluations and revaluations as well as market forces and official interventions have shaped the course of international exchange rates.

One can define various measures of the exchange rate, depending on the purpose for which it is to be used. Commonly used measures are the nominal exchange rate, the effective exchange rate, the real exchange rate, and the equilibrium exchange rate. For the benefit of those who may not be familiar with these measures, we will explain them briefly to clear the way for moving on to the measure that is of interest in this study.

The nominal exchange rate (NER) is simply the official exchange rate at which one currency is exchanged for another. The NER for any two currencies is the "bilateral exchange rate." A "multilateral exchange rate," also known as "effective exchange rate," can also be computed weighting the component currencies by the value of trade with each trading partner. With the use of paper money and possible intervention policies, the NER may be quite artificial. For example, nations can deliberately fix the value of their currencies to gain competitive edge over their trading partners or as a macroeconomic anchor. This highlights the usefulness of obtaining alternative measures, which try to relate the exchange rate to the competitiveness and overall performance of the economy.

An important measure of the exchange rate in this regard is the "real exchange rate" (RER). There is no unique measure of the RER. Two measures commonly encountered in the literature are based on the "external" and "internal" concepts.

The external concept of the RER is based on the purchasing power parity (PPP) definition. In its absolute form, the PPP defines the RER as the NER adjusted for relative domestic and foreign prices.

Thus,

$$RER = NER^{*} (Pd/Pf) \quad \text{----------} \quad (1)$$

Where, NER is measured here as foreign currency units per domestic currency, and Pd and Pf are domestic and foreign prices respectively.

So defined, an increase in RER indicates real appreciation whereas a decrease indicates real

depreciation. The most common challenge of using this definition is the problem of finding appropriate proxies for the price indices involved.

The internal concept of RER, on the other hand, is based on the relative prices of nontradables and tradables. The RER is here defined as:

RER = PNT/PT ----------(2)

Where:

PT = Price of tradables
PNT = Price of non-tradables

In this case also, an increase implies RER appreciation, whereas a fall indicates depreciation. In other words, when the price of nontradables rises relative to the price of tradables, the RER appreciates, whereas if the price of tradables increases relative to the price of nontradables, the RER depreciates. The problem with using the internal RER empirically is that disaggregated prices for tradables and nontradables may not always be available.

In practice, one will have to choose an RER definition that is easier to measure especially in terms of availability of data.

The NER, whether in bilateral or multilateral/effective terms, and the RER represent actual, observable values of the exchange rate. They do not however tell us what the (long-run) equilibrium values are. Knowing the equilibrium real exchange rate (ERER) in particular, is important because it enables a determination to be made about the "right" nominal exchange rate (NER), an important policy instrument. For instance in Ghana where the currency has experienced incessant depreciation, it is still not always clear whether the rate has overshot or undershot its "equilibrium value" or to what extent it is "misaligned." The right NER is the one that ensures that the actual real exchange rate (ARER) coincides with its equilibrium value, the ERER. A deviation of the ARER from the ERER denotes exchange rate misalignment, implying that the currency is either overvalued or undervalued. To mitigate the potential adverse effects on the economy, misalignment should elicit corrective policy actions.

In the theoretical literature, three main approaches are encountered for determining the ERER. These are the purchasing power parity equilibrium approach, the macroeconomic balance or fundamental equilibrium approach and the behavioral equilibrium approach.

The PPP equilibrium real exchange rate (PPPERER) is assumed to be constant. It is taken to be the rate of the year in which the current account is in balance. The PPP approach also assumes that the NER adjusts rapidly to price differentials between a country and its trading partners. The problem with the PPP approach however is that, it has the absolute PPP, which has been found not to hold always (Elbadawi and Soto, 1997), as its foundation. In general, the ERER is not generally regarded as constant but rather to vary as the underlying fundamentals vary.

The fundamental equilibrium real exchange rate (FERER) (Williamson, 1985; Faruqee and Isard, 1998) is considered to be the rate that ensures simultaneous attainment of both inter-

nal andexternal balance or equilibrium. Internal equilibrium implies full employment and low inflation. External equilibrium, on the other hand, represents sustainable current account deficit, i.e. one that can be financed without undue recourse to borrowing or loss of reserves. Hence, the FERER is a range of values rather than an immutable number suggested by the PPP approach, and changes over time as the fundamental determinants change. The fundamental determinants are the factors that determine internal and external balance.

The behavioral equilibrium real exchange rate (BERER) (Edwards, 1988, 1989; Clark and McDonald, 1998, 2000) is determined based on a model that specifies a long-run and short-term relationship between the observed RER and a vector of fundamentals. These fundamentals include, but are not limited to: productivity, terms of trade or export commodity prices, openness to trade, international reserves or capital flows, government expenditure and relative interest rates.

Empirically, to determine (real) exchange rate misalignment, one has to determine both the actual real exchange rate (ARER) and the equilibrium real exchange rate (ERER). The misalignment at any time (RERMt) is then computed as:

RERMt = [(ARERt-ERERt)/ERERt)]*100% ---------- (3)

To determine the ARER, one has to choose between the external and the internal measures discussed above. To determine the ERER, the choice is between the PPPERER, FERER, and the BERER approaches. The choice of approach for determination of both the ARER and ERER will depend on data availability as well as each country's circumstances. Empirical evidence for China, a group of transition economies, South Africa, Botswana, Nigeria, and Ghana (3 studies) is reviewed immediately below. Exchange rate misalignment tends to be a major problem in developing countries, supporting the bias of the case studies cited here.

Zhang (2001) investigates real exchange rate misalignment in China. He uses the internal concept measure for the ARER and the BERER approach for the ERER and a sample period from 1952 to 1997. The fundamental determinants of the BERER used are: the index of gross fixed capital formation; fiscal policy captured by the index of government consumption; the growth of exports; and the degree of openness measured as a ratio of the sum of the imports plus exports to GDP (Zhang, 2001). The cointegration tests reveal that the sign of the coefficient of the productivity variable is not in agreement with the theoretical literature since it reveals that a rise in technological progress will result in a depreciation of the RER. The results also reveal that an increase in government spending will result in an appreciation of the RER which is in line with a priori expectations and this implies that government consumption is channeled towards the non-tradables goods sector. The growth in exports variable shows that an improvement in the terms of trade will result in an appreciation of the RER, which is in support of the theoretical literature in the case where the substitution effect outweighs the income effect. The openness variable results in exchange rate depreciation. This is in line with the a priori assumptions put forward in Montiel (1999) (Zhang, 2001). The findings provide evidence of exchange rate misalignment as China's exchange rate was overvalued from 1957 to 1977 and generally undervalued from 1978 to 1993. After 1977, where overvaluation may have appeared, it was small in magnitude and short-lived.

De Broek and Slok (2006) apply a cross-sectional analysis as well as a time series analysis to assess the level of misalignment in 26 transition economies covering the period 1991-98. The cross-sectional analysis sample includes 10 EU accession countries and 16 other transition economies. The time series analysis estimates a BERER model using productivity, money-to-GDP ratio, trade openness, government consumption, commodity prices and the terms of trade. The results suggest that an increase in productivity will result in the countries exchange rates appreciating, in line with the a priori assumptions. In terms of the money-to-GDP variable, the findings suggest that the exchange rate depreciated due to positive monetary shocks in the 16 transition countries, which is also in agreement with theoretical literature. In the EU accession countries and the OECD countries, increases in the openness and the government consumption variables depreciate and appreciate the exchange rate respectively. The terms-of-trade variable is not statistically significant in any of the samples. Increases in commodity prices lead to exchange rate depreciation in the 16 transition countries, contrary to theoretical expectations. The results of the cross-sectional analysis show that the exchange rates are generally misaligned at the beginning of the transition period, and as the years passed, the misalignment is corrected.

Asfaha and Huda (2002) use a one-step Engel-Granger technique and a five year moving average technique to estimate the exchange rate misalignment in South Africa from 1985 to 2000. The long-run fundamentals in this case are terms of trade; government expenditure; openness of capital account; trade restrictions; technological and productivity improvements. An improvement in the terms of trade as well as an increase in government expenditure results in the appreciation of the currency. This highlights that the bulk of government consumption is on non-tradables. The capital account openness variable supports the theoretical literature and strongly suggests that the openness of the capital account allows for capital inflows resulting in the appreciation of the exchange rate. The technology advancement variable which is a proxy for the Balassa-Samuelson effect is in agreement with the theoretical literature as it causes the exchange rate to appreciate (Asfaha and Huda, 2002:10-11). Their findings suggest that from the third quarter of 1988 to the second quarter of 1998, the Rand was overvalued. Episodes of undervaluation were present from the first quarter of 1985 to the first quarter of 1988 and also from the second quarter of 1997 to 2000. Using the Vector Autoregressive (VAR) techniques they found that the exchange rate misalignment during the period covered account for 20 percent variation of the South African economy's international competitiveness (Asfaha and Huda, 2002:14).

Iimi (2006) applies the BEER method to assess whether the exchange rate in Botswana is misaligned with its economic fundamentals for the period from 1985 to 2004. The fundamentals used to estimate the equilibrium exchange rate include the interest rate differential variable; the terms of trade variable; a proxy for the Balassa–Samuelson effect; fiscal risk premium variable which depends on government income and expenditure; and the net foreign assets (capital inflow) variable. The findings are in agreement with the theoretical literature in all cases except for the finding that an increase in the net foreign assets results in an equilibrium depreciation of the currency. There is evidence that in the late 1980s the Pula was undervalued whereas in the later years of the study [only went up to 2004], it was overvalued by 5 percent, which had an effect on Botswana's competitiveness in the short- and medium-term.

Aliyu (2007) estimates the exchange rate misalignment for Nigeria for 1986:Q1-2006:Q4, using the BEER method along with others. The fundamental determinants include terms of trade, net foreign assets, index of crude oil price volatility, government fiscal stance, the foreign reserve level relative to GDP and finally monetary policy. The results reveal that the coefficient of net foreign assets is consistent with theory as an increase in the net foreign asset will result in a RER appreciation. A unit increase in the index of crude oil price volatility and monetary policy will result in an appreciation of the RER which is also consistent with the literature. The coefficient of the government fiscal stance is positive reflecting a depreciation of the exchange rate and this variable is theoretically consistent if government expenditure is on tradable goods. An increase in the terms of trade results in the appreciation of the RER, which is in support of theoretical literature. The reserves level to GDP variable indicates that an increase in the net foreign reserves will depreciate the Naira. This is inconsistent with the theoretical expectation, and it suggests that there is no evidence of the Dutch disease in Nigeria. The results obtained also suggest that the exchange rate was overvalued from 1986:Q1 to1989:Q2; from 1992:Q1 to 1993:Q4; from 1995:Q2 to 1996:Q1; and from 1999:Q2 to 2001:Q3. Aliyu (2007) attributes this to policy changes that occurred during these periods. From the third quarter of 1989 to the fourth quarter of 1991; from the first quarter of 1994 to the first quarter of 1995; from the second quarter of 1996 to the first quarter of 1999; and from the fourth quarter of 2001 to the fourth quarter of 2006, the exchange rate in Nigeria was undervalued. This last period of undervaluation is attributed to good democratic practice, foreign exchange inflows owing to the rise in crude oil prices, and gains from the banking sector consolidation experienced in Nigeria at the time.

Sackey (2002) develops a model for the equilibrium exchange rate in Ghana for the period 1962-96. The long-run determinants of the equilibrium exchange rate are terms of trade; net foreign aid inflows; government consumption; "commercial policy" (openness); and technological progress. The short-run determinants of the equilibrium exchange rate include the above- mentioned variables, excluding the terms of trade and including the nominal devaluations variable. In the long-run model, increases in the external terms of trade and the net foreign aid inflows result in a depreciation of the exchange rate whereas an increase in government consumption, commercial policy and technological progress appreciate the exchange rate. These results are in line with economic theory with the exception of the aid variable which refutes the notion of the Dutch disease where an increase in net foreign aid inflows is expected to appreciate the exchange rate (Sackey, 2002:24). In the short-run, the coefficients of the variables are the same as was the case in the long-run for the aid, government consumption, commercial policy and the technological progress variables. The nominal devaluations variable depreciates the exchange rate in the short-run, which is also as expected in the theoretical literature.

In a study by Youngblood and Apaloo (2006) for1965-2004, the fundamental determinants of the equilibrium exchange rate include the terms of trade, net capital inflows and commercial policy (openness). The paper suggests that a decline in the terms of trade depreciates the currency, which is in support of the a priori assumptions. The openness variable exhibits a negative coefficient, which means that an increase in openness will depreciate the currency, which is in line with the theoretical literature. In terms of the capital inflows variable, as capital inflows increase, the currency is expected to appreciate which is also in line with the Montiel (1999) model. The findings also reveal that in the long-run the exchange rate in Ghana will

most likely trend towards the equilibrium. In the short-run, divergences in the Ghana cedi will arise due to cyclical changes in fundamentals and policies that impede convergence.

Iossifov and Loukoianova (2007) apply the BEER method as well as the Vector Error Correction Models (VECM) for the period 1983:Q1-2006:Q3 to estimate the equilibrium RER for Ghana. The variables used include the per capita growth rate differential between Ghana and its major trading partners; the real interest rate differential; and the weighted average real world prices of Ghana's four main export commodities. The results reveal that increases in all three variables lead to an exchange rate appreciation, consistent with the a priori expectations. The error correction estimates reveal that in each quarter 14 percentage points of any misalignment between actual and equilibrium RER is corrected. Their findings also suggest that after a shock, the RER reverts back to equilibrium provided the shocks do not reoccur. In the third quarter of 2006, for example, the actual RER was close to its equilibrium value. This followed the period between 1999 and 2000 when the actual RER was below its equilibrium value.

4.0 Model specification

In specifying a model for determination of the ERER, the choice is between the PPPERER, FERER, and the BERER approaches. The BERER approach is the one most commonly used in empirical studies, including those cited above. This approach is convenient and easy to model and is used in this study. The distinction between this study and others lies in the choice of variables for the determination of the ERER and the choice of study period.

Based on the theoretical approach by Edwards' (1989), which is applied by Mathisen (2003) in his study for Malawi, the model used captures both the long-run and short-run determinants of the ERER. In this model, the ERER is determined by "fundamental" or "real" variables in their steady states, while deviations of the variables from their steady states result in deviations from the ERER.

Following the literature and also based on data availability, the following variables are used to determine ERER:

1. Total government expenditure as a ratio of GDP (TGE/GDP);
2. Productivity, measured as per capita GDP (PC/GDP);
3. Total foreign reserves as a ratio of GDP (TR/GDP);
4. Relative real interest rate (RRIR), defined as domestic interest rate relative to trade-partners interest rate; For Ghana, the Treasury bill rate is used as the representative interest rate; LIBOR is used as the representative trade-partners' interest rate;
5. Terms of trade (TOT), defined as export unit values relative to import unit values, as a ratio of GDP;
6. Trade openness, defined as the sum of exports and imports, relative to GDP (OP/GDP);
7. Domestic (private sector) credit as a ratio of GDP (DC/GDP); and
8. Budget deficit as a ratio of GDP (BD/GDP).

In sections of the literature, variables 1-6 are referred to as "fundamental or "real" variables. Changes in these variables can cause the real exchange rate to deviate from its equilibrium level both in the long run and the short run. Variables 7-8, on the other hand, are referred to as nominal (macroeconomic policy) variables. Changes in those variables usually affect the path of the real exchange rate in the short run.

It has to be pointed out that the ERER is not directly observable or measurable and, therefore, cannot be modeled and estimated directly. ARER, however, is directly observable or measurable. The two are, however, linked in the literature, which postulates that the observable ARER has two components: the ERER and deviations from ERER. This link can be stated in equation form as:

ARER=f[ERER, deviations from ERER] ---------- (4)

The equation to be estimated can therefore be stated as a relationship between ARER and the determinants of ERER cited above, i.e.

ARER= f [TGE/GDP, PCGDP, FR/GDP, RRIR, TOT, OP/GDP, DC/GDP, BD/GDP] ------- (5)

The respective impact of the explanatory variables on ARER is not unambiguous in many cases. In general, the impact depends on the relative effect of a change in the variable on the prices of tradables and nontradables. In principle, if the change increases (decreases) the price of tradables relative to that of nontradables, then the effect on ARER is negative (positive), which implies a depreciation (appreciation). Alternatively, the impact can be inferred from the effect of a change in the variable on the external accounts. In general, if the change improves (worsens) the external account, the effect is an appreciation (depreciation).

Based on theory and empirical evidence, the following tentative deductions can be made regarding the direction of impact of the individual regressors:

TGE/GDP: The total government expenditure used is an omnibus item comprising recurrent and capital components, which can be further disaggregated. If TGE is mostly directed toward nontradables (tradables), its effect on real exchange rate will be positive (negative), implying appreciation (depreciation). As measured, the sign of TGE/GDP cannot, therefore, be unambiguously pre-determined. The preponderance of the literature suggests a positive sign (appreciating effect) for government expenditure.

PCGDP: Most of the literature postulates that an increase in productivity of a country will usually raise its relative wage, which in turn will reflect in higher prices of its nontradables and thereby cause the ARER to appreciate. This implies that the sign of PCGDP is expected to be positive. This is the so-called Balassa-Samuelson effect ( ). However, higher productivity could result in lower relative price of tradables and thereby cause the real exchange rate to depreciate. A negative sign for PCGDP should therefore not be ruled out. The preponderance of the literature suggests a positive sign (appreciating effect) for productivity

TR/GDP: Higher foreign reserves, just like capital flows and net foreign assets, the alternative proxies used in the literature, would boost demand in the economy. If such demand is directed mostly at nontradables (tradables), it will cause the real exchange rate to appreciate (depreciate). Alternatively, to the extent that higher foreign reserves may accommodate larger external deficits, it can cause the ARER to depreciate. In general, the sign of FRGDP could, therefore, go either way. The preponderance of the literature suggests a positive sign (appreciating effect) for reserves in line with the "Dutch disease" syndrome.

RRIR: An increase in real relative interest rates relative to trading partners is expected to draw in capital from abroad, which like foreign reserves, would boost demand in the economy. If such demand is directed mostly at nontradables (tradables), it will cause the real exchange rate to appreciate (depreciate). In general, the sign of RRIR could be positive or negative.

TOT: An increase in the terms-of-trade is postulated to increase national "wealth," which is expected to increase domestic demand and, hence, the relative price of nontradables. In that sense, the effect on real exchange rate is expected to be positive, implying appreciation.

OP/GDP: Generally, increased trade openness is expected to increase demand for imports and reduce relative demand for nontradables. The effect will be a worsening of the current account

and a fall in the relative price of nontradables, which will cause the RER to depreciate. On the other hand, openness to trade may increase competition in the tradables sector and cause the relative price of tradables to fall. This will result in the appreciation of the real exchange rate. The sign of TOGDP is, therefore, not unambiguously pre-determined. The preponderance of the literature suggests a negative (depreciating effect) for trade openness.

DC/GDP: In general, domestic credit expansion in the context of expansionary macroeconomic policy will increase domestic demand. If the increased demand is directed mostly toward tradables (nontradables) then it will cause the real exchange rate to depreciate (appreciate). Most of the literature however tends to lean towards the latter, in which case the sign of DCGDP is more likely to be positive.

BD/GDP: Just like domestic credit, higher government deficit that is monetized in the context of expansionary macroeconomic policy, will, in general, increase domestic demand. If the increased demand is directed mostly toward tradables (nontradables) then it will cause the real exchange rate to depreciate (appreciate). Just as for DC/GDP, most of the literature tends to lean towards the latter, in which case the sign of FD/GDP is more likely to be positive.

The above analysis concerning the impact of the variables on the real exchange rate assumes that the nominal rate does not change. This is because a change in the nominal exchange rate can also affect the real exchange rate. As such, it was decided to include the nominal exchange rate (NER) as an explanatory variable. So defined (as foreign currency units per domestic currency), an increase (decrease) in NER, other things remaining the same, will cause real exchange rate to appreciate (depreciate). In other words, NER is expected to have a positive sign.

Measurement of the actual real exchange rate (ARER)

As noted in Section 3.0 above, the actual real exchange rate (ARER) can be measured based on either the external (PPP) concept or the internal (nontradable-tradable prices) concept. Both measurements, as noted, have their merits and demerits. In Ghana, disaggregated data for tradable and nontradable prices is not wholly available. This constraints the use of the internal concept measure for the ARER. The trade-weighted PPP measure—the real effective exchange rate (REER)—is, however, published by the IMF and was used for this study.

The REER is defined as:

$$REER=\Sigma wi[NER^{*}\ (P/Pi^{*})\ ] \quad \text{----------} \quad (6)$$

Where NER is the nominal exchange rate defined here as foreign currency units per domestic currency; wi represents trade-weights; and P and Pi* represent domestic and trade-partner prices respectively.

Period of study: 1980-2010

Table 2: Data Definitions and Sources

Variable	Definition	Description	Source	Unit
CPID	2005=100	CPI Ghana (Domestic)	WDI	
CPIF	2005=100	CPI USA (Foreign)	WDI	
NER	Dollar per Cedi	Nominal Exchange Rate	WDI	
RP	CPID/ CPIF	Relative Prices	Author	
REER		Real Effective Exchange Rate	WDI	
TGE	Government Expenditure/ GDP	General Government Expenditure (% of GDP)	WDI	Percent (%)
PCGDP	GDP/ Population	GDP per capita	WDI	Local Currency Unit
FR		Foreign Reserves		
RRIR	(T-bill Rate/LIBOR)*	Real Interest Rate Relative to	Author	

TOT	Export Unit Value indexes/ impoert Unit Value indexes (2000=100)	Net Barter Terms of Trade (Index)	WDI	
DC/GDP	Domestic Credit to Private Sector/ GDP	Domestic Credit to Private Sector (% of GDP)	WDI	Percent (%)
BD/GDP	Absolute Value of Budget Balance	Fiscal Budget Deficit (% of GDP)	IMF	Percent (%)
OP	(Export+ Import) / GDP	Openness to Trade	WDI	Percent (%)

Table 3: Real Effective Exchange Rate

Year	REER(2005=100
1980	750.54
1981	1,669.30
1982	2,092.27
1983	3,578.94
1984	545.97
1985	397.58
1986	251.51
1987	188.29
1988	169.76
1989	158.56
1990	157.50
1991	160.78
1992	141.83
1993	123.92

1994	100.38
1995	115.95
1996	125.99
1997	133.30
1998	142.25
1999	140.49
2000	91.94
2001	92.95

Table 4: Total Government Expenditure as a Ratio of GDP

Year	General Government Total Expenditure as % of GDP
1980	11.2
1981	16.3
1982	9.1
1983	14.0
1984	10.4
1985	12.1
1986	16.3
1987	13.9
1988	13.6
1989	13.4
1990	11.8
1991	11.3
1992	14.4
1993	19.8
1994	21.7
1995	24.2
1996	22.5
1997	19.2
1998	18.3
1999	16.8
2000	20.1
2001	23.1
2002	17.1
2003	20.4
2004	20.5
2005	19.5
2006	21.8
2007	23.1
2008	24.5
2009	22.3
2010	23.9

Table 5: Per Capita Gross Domestic Product

Year	GDP Per Capita (constant LCU)
1980	667.6
1981	625.7
1982	563.4
1983	519.2
1984	544.9
1985	554.5
1986	566.1
1987	576.9
1988	593.2
1989	606.8
1990	610.0
1991	624.4
1992	630.4
1993	642.5
1994	645.7
1995	654.8
1996	667.9
1997	679.4
1998	694.7
1999	708.4
2000	717.4
2001	728.4

Table 6: Foreign Reserves as a Ratio of GDP

Year	Foreign Reserves as % of GDP
1980	12.4848
1981	10.5373
1982	13.2575
1983	12.8736
1984	17.7837
1985	21.3681
1986	22.9571
1987	11.6436
1988	10.3153
1989	13.7881
1990	9.4682
1991	18.7328
1992	11.5189
1993	13.8000
1994	17.8116
1995	19.9513
1996	22.0739
1997	14.0652
1998	9.9335
1999	11.1410
2000	6.2060
2001	7.2622

Table 7: Real Relative Interest Rate

Year	Real Relative Interest Rate
1980	342.3443
1981	146.3401
1982	156.1948
1983	99.0227
1984	71.0808
1985	104.9531
1986	117.2453
1987	95.6492
1988	62.0949
1989	45.5675
1990	42.7639
1991	69.5064
1992	67.3671
1993	101.4292
1994	50.0942
1995	34.3112
1996	30.9011
1997	24.2732
1998	18.1480
1999	12.7808
2000	12.0646
2001	18.8032

Table 8: Terms of Trade as a Ratio of GDP

Year	Index of Terms of (Px/Pm) (2000 = 100)
1980	209.5
1981	185.7
1982	125.0
1983	170.4
1984	132.0
1985	123.3
1986	135.4
1987	131.9
1988	125.8
1989	105.7
1990	100.0
1991	102.0
1992	95.1
1993	89.2
1994	94.2
1995	106.7
1996	108.6
1997	114.0
1998	124.2
1999	109.6
2000	100.0

Table 9: Domestic Credit as a Ratio of GDP

Year	Domestic Credit to Private Sector as % of GDP
1980	2.3
1981	1.8
1982	1.8
1983	1.5
1984	2.2
1985	3.1
1986	3.6
1987	3.2
1988	3.1
1989	5.8
1990	4.9
1991	3.7
1992	4.9
1993	4.8
1994	5.3
1995	5.1
1996	6.0
1997	8.2
1998	9.4
1999	12.6
2000	14.0
2001	11.9

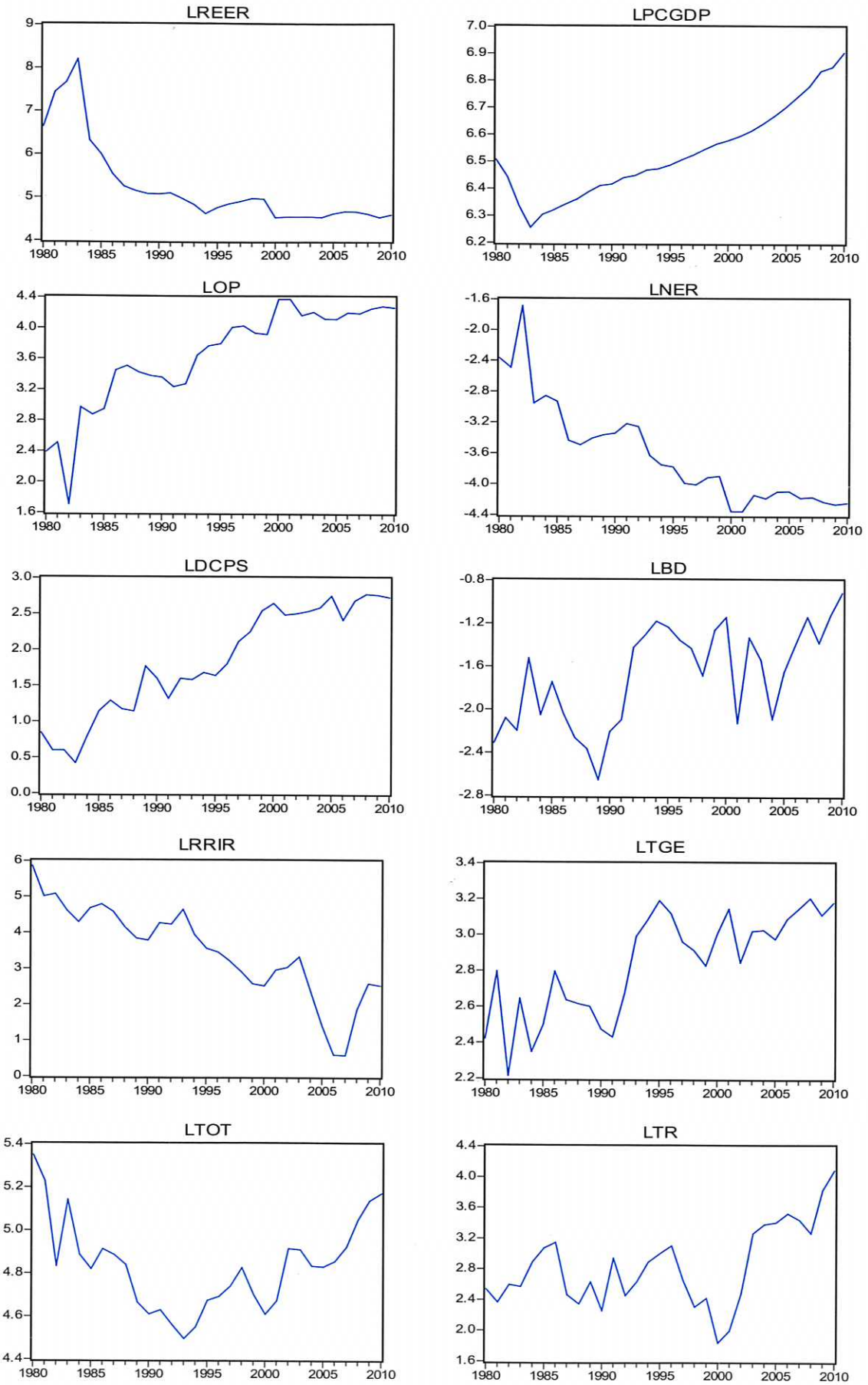
Table 10: Fiscal Deficit as a Ratio of GDP

Year	Fiscal Deficit as % of GDP
1980	0.0983
1981	0.1239
1982	0.1100
1983	0.2162
1984	0.1274
1985	0.1731
1986	0.1291
1987	0.1029
1988	0.0930
1989	0.0697
1990	0.1092
1991	0.1221
1992	0.2387
1993	0.2677
1994	0.3055
1995	0.2883
1996	0.2561
1997	0.2372
1998	0.1837
1999	0.2802
2000	0.3167
2001	0.1181

Table 11: Openness to Trade (Exports + Imports) / GDP

Year	Openness to Trade	Openness to Trade (%)
1980	0.1079	10.7871
1981	0.1220	12.2000
1982	0.0546	5.4640
1983	0.1932	19.3155
1984	0.1755	17.5535
1985	0.1890	18.9018
1986	0.3129	31.2902
1987	0.3321	33.2065
1988	0.3042	30.4166
1989	0.2911	29.1137
1990	0.2850	28.4972
1991	0.2522	25.2180
1992	0.2620	26.2021
1993	0.3810	38.0952
1994	0.4299	42.9854
1995	0.4416	44.1594
1996	0.5454	54.5443
1997	0.5547	55.4676
1998	0.5060	50.6007
1999	0.4979	49.7920
2000	0.7854	78.5395
2001	0.7866	78.6617
2002	0.6340	63.3953
2003	0.6639	66.3878
2004	0.6081	60.8099
2005	0.6052	60.5200
2006	0.6592	65.9231
2007	0.6536	65.3556
2008	0.6951	69.5133
2009	0.7159	71.5920
2010	0.7034	70.3365

Chart 1: Data Plots



5. Model estimation results

The regression equation () was estimated with E-views based on the Error Correction Model (ECM). The estimated equation comprises the long-run cointegration component and the short-term error-correction component.

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.590262	25.88446	15.49471	0.0010
At most 1	0.000331	0.009604	3.841466	0.9216

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.590262	25.87486	14.26460	0.0005
At most 1	0.000331	0.009604	3.841466	0.9216

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Cointegrating Eq:	**CointEq1**
LREER(-1)	1.000000
LPCGDP(-1)	1.277380*
	(0.58346)
	[2.18932]
C	-9.271344
	(4.72246)
	[-1.96324]

Error Correction:	D(LREER)
CointEq1	-0.974335*
	(0.15978)
	[-6.09779]
D(LREER(-1))	-0.277695
	(0.17031)
	[-1.63057]
D(LPCGDP(-1))	-9.960301*
	(3.57882)
	[-2.78312]
LOP	-1.352140*
	(0.28193)
	[-4.79608]
LDCPS	0.096652
	(0.21244)
	[0.45497]
LBD	0.170713
	(0.14002)
	[1.21917]
LRRIR	-0.163585*
	(0.07538)
	[-2.17028]
LTGE	0.790282*
	(0.38935)
	[2.02973]
LTOT	1.754324*
	(0.35296)
	[4.97026]
LTR	-0.305877*
	(0.12781)
	[-2.39327]
R-squared	0.725209
Adj. R-squared	0.695045
Sum sq. resids	1.188305
S.E. equation	0.250085
F-statistic	5.571504
Log likelihood	5.174915
Akaike AIC	0.332764
Schwarz SC	0.804246
Mean dependent	-0.097892
S.D. dependent	0.392992

Estimated equation:

D(LREER) = - 0.9743346469*(LREER(-1) + 1.277380461*LPCGDP(-1) - 9.271344016) - 0.2776953132*D(LREER(-1)) - 9.960300889*D(LPCGDP(-1)) - 1.352140256*LOP + 0.09665248064*LDCPS + 0.1707128984*LBD - 0.1635853242*LRRIR + 0.7902820466*LTGE + 1.754323871*LTOT - 0.3058770013*LTR ---------- (7)

The results indicate existence of significant long–run (co-integrating) and short-run (error-correction) relationship between the real effective exchange rate and its determinants for the study period. Productivity has both a long-run impact and a short-run impact on the real exchange rate. All the other variables (openness, domestic credit, the budget deficit, real relative interest rate, government expenditure, terms-of- trade and foreign reserves) have short-run impact on the real exchange rate.

In terms of direction of impact, productivity has a significant positive (appreciating) impact on the real exchange rate in the long run. This is in line with the preponderance of the literature that suggests that an increase in productivity raises the relative wage, which in turn reflects in higher prices of nontradables (the Balassa-Samuelson effect). A unit increase in productivity causes the real exchange rate to appreciate by 1.28 percent in the long-run. The long-run direction of causation agrees with the findings of Iossifov and Loukoianova (2007) for Ghana. In the short-run, however, productivity has a significant negative (depreciating) impact on the real exchange rate, apparently supporting the theory that higher productivity could cause the relative price of tradables to fall. In the short run, a unit increase in productivity causes the real exchange rate to depreciate by 9.96 percent.

Trade openness has a significant negative (depreciating) impact on the real exchange rate. This is consistent with the preponderance of the literature that suggests that increased trade openness increases demand for imports and reduces relative demand for nontradables, which causes a fall in the relative price of nontradables, and the current account to worsen. A unit increase in trade openness causes the real exchange rate to depreciate by 1.4 percent. Daboh (2010), on the other hand, found a significant long-run appreciating impact of trade openness on the real exchange rate for Ghana, supporting the alternative theory that trade openness may increase competition in the tradables sector and cause the relative price of tradables to fall.

Real relative interest rate has a significant negative (depreciating) impact on the real exchange rate. This supports the theory that capital inflow that may result from an increase in the real relative interest rate is directed mostly at tradables. A unit increase in the relative real interest rate causes the real exchange rate to depreciate by 0.16 percent. Iossifov and Loukoianova (2010), on the other hand, found a positive (appreciating) effect of an increase in the relative real interest rate on the real exchange rate for Ghana, confirming the alternative hypothesis that increased demand from the induced capital flows is directed mostly at nontradables.

Total government expenditure has a significant positive (appreciating) impact on the real exchange rate. This supports the preponderance of the literature that it is mostly directed toward nontradables. A unit increase in government expenditure causes the real exchange rate to appreciate by 0.79 percent. Daboh (2010), on the other hand, found a negative (depreciat-

ing) impact of government expenditure for Ghana, supporting the alternative hypothesis that tradables receive the most impact of government expenditure.

The terms-of-trade has a significant positive (appreciating) impact on the real exchange rate. This is consistent with the preponderance of the literature that an increase raises national "wealth" that leads to higher domestic demand directed at nontradables. A unit increase in the terms of trade causes the real exchange rate to appreciate by 1.75 percent. Daboh(2010) also found a similar significant effect on and direction of causation between the terms of trade and the real exchange rate for Ghana, as did Iossifov and Loukoianova (2010) who used a weighted average real world price of Ghana's four predominant export commodities as the alternative proxy.

Foreign reserves have a significant negative (depreciating) impact on the real exchange rate. This supports the theory that an increase boosts demand that is directed mostly at tradables. A unit increase in foreign reserves causes the real exchange rate to depreciate by 0.3 percent. The result, however, is not consistent with the preponderance of the literature that suggests a positive sign (appreciating effect) for reserves in line with Dutch disease. It, however, agrees with the findings of Aliyu (2007) for Nigeria, and Sackey (2002) and Daboh (2010) for Ghana who did not find evidence of Dutch disease in their studies.

Domestic credit has a positive (appreciating) impact on the real exchange rate, in line with the theory that domestic credit expansion increases domestic demand that is directed mostly toward nontradables. The effect of credit on the real exchange rate is, however, not significant. Daboh (2010) found a significant positive (appreciating) effect of domestic credit on the real exchange rate for Ghana. The fiscal deficit also has a positive (appreciating) effect in line with preponderance of the theory. However, the impact is not significant.

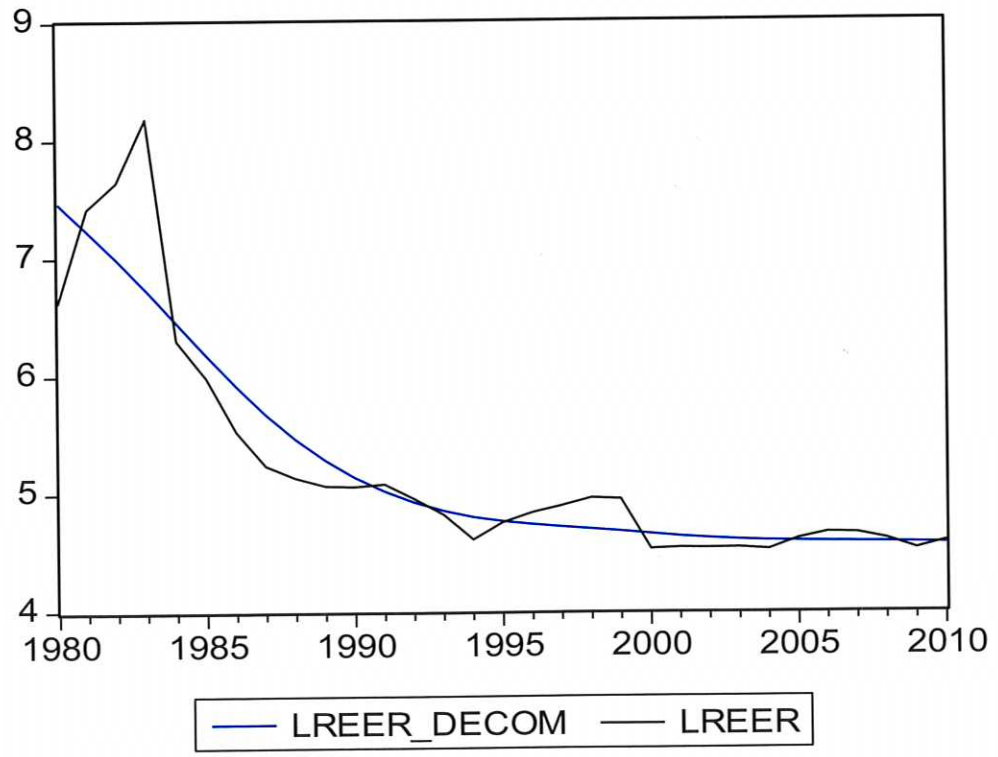
The nominal exchange rate, defined as the Ghana-US bilateral rate, did not provide satisfactory results and therefore had to be excluded from the regressions. The nominal effective exchange rate should normally be used, but lack of a complete series for it did not permit this. This is an issue that needs to be taken up in future work.

Table 12: Estimated REER vs ERER

YEAR	LREER	LREER-DECOM	DIFF	MISALIGNMENT
1980	6.6208	7.4719	-0.8511	Undervaluation
1981	7.4202	7.2361	0.1841	Overvaluation
1982	7.6460	6.9918	0.6542	
1983	8.1828	6.7323	1.4506	
1984	6.3026	6.4575	-0.1549	Undervaluation
1985	5.9854	6.1817	-0.1963	
1986	5.5275	5.9179	-0.3904	
1987	5.2380	5.6768	-0.4388	
1988	5.1344	5.4655	-0.3311	
1989	5.0661	5.2864	-0.2203	
1990	5.0594	5.1389	-0.0795	

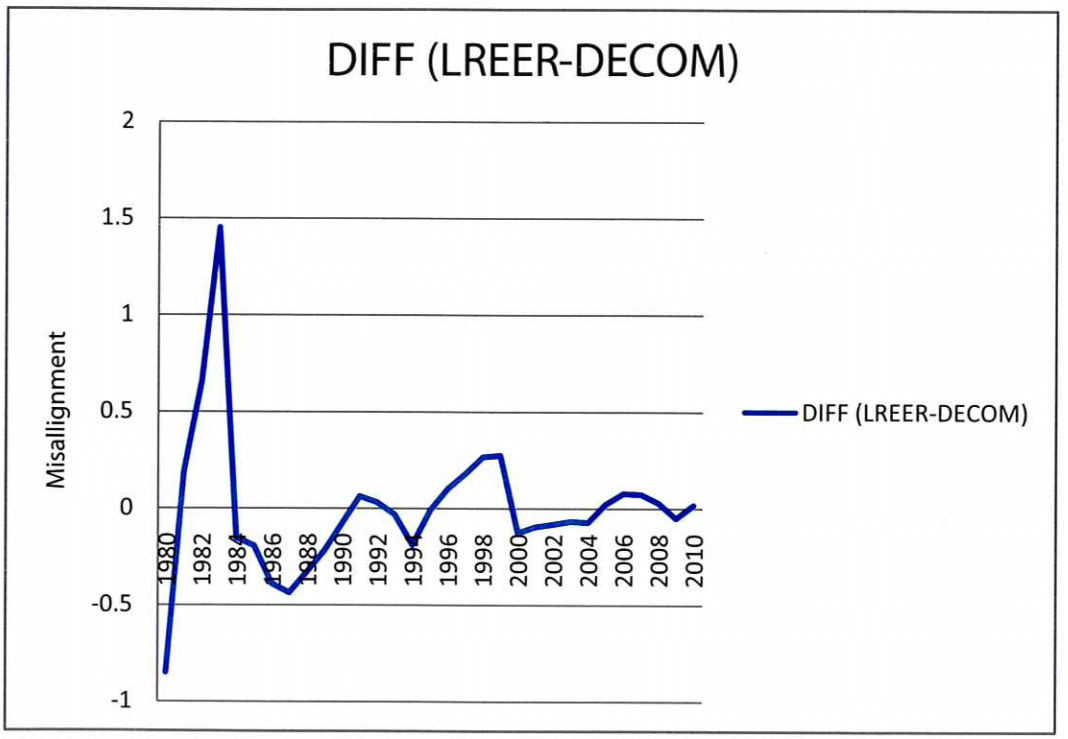
1991	5.0800	5.0201	0.0510	Overvaluation
1992	4.9546	4.9261	0.0286	
1993	4.8196	4.8539	-0.0343	Undervaluation
1994	4.6090	4.8006	-0.1916	
1995	4.7532	4.7630	-0.0098	
1996	4.8362	4.7360	0.1002	Overvaluation
1997	4.8926	4.7144	0.1782	
1998	4.9576	4.6940	0.2636	
1999	4.9451	4.6724	0.2728	
2000	4.5211	4.6497	-0.1286	Undervaluation
2001	4.5321	4.6290	-0.0969	
2002	4.5277	4.6119	-0.0841	
2003	4.5303	4.5990	-0.0686	
2004	4.5162	4.5902	-0.0740	
2005	4.6052	4.5847	0.0205	Overvaluation
2006	4.6563	4.5808	0.0755	
2007	4.6496	4.5773	0.0722	
2008	4.6003	4.5735	0.0266	
2009	4.5169	4.5694	-0.0526	Undervaluation
2010	4.5813	4.5656	0.0157	Overvaluation

Chart 2: Estimated real effective exchange rate (REER) vs. the equilibrium real exchange rate (ERER)



The ERER, represented in Chart 1 by the LREER_DECOM line, the permanent component of REER, follows a declining path during the study period. This implies that the combined effect of the fundamental factors pulling it down—i.e. productivity (net effect), relative real interest rate, and foreign reserves–outweighs that of those pulling it up—i.e. government expenditure, and terms-of-trade. This also implies that there has been constant downward pressure on the actual real exchange rate, measured in this study as the real effective exchange rate (REER). This is because any deviation of REER from ERER must be corrected over time. The speed of adjustment of REER to the ERER or correction of any misalignment is measured by the error correction coefficient (ECF) in the model. In this case, the ECF is -0.97. This implies that 97% of any misalignment is corrected within a year. This is a relatively fast speed of adjustment and confirms the findings for Ghana by Daboh (82% within a year) and Mathisen (27% within a quarter or 98% within a year). Iossifov and Loukoianova found a less boisterous pace of adjustment (14% within a quarter or 56% within a year) for Ghana.

Chart 3: Difference between REER and ERER



The direction and degree of misalignment of the real exchange rate for various sub-periods during the study period (1980-2010) can be deduced from Table 12, and Charts 2 and 3. What is clear is evidence of misalignment one way or the other throughout the entire period. This agrees generally with the findings for Ghana by Daboh (study period 1970-2006) and by Iossifov and Loukoianova (study period 1984-2006). Apart from 1981-83, when overvaluation is strongly indicated, the rest of the period does not indicate any strong trend bias towards overvaluation or undervaluation.

The results of the study show clear evidence of misalignment of the real exchange rate one way or the other—i.e. overvaluation or undervaluation—throughout the period. Starting from a position of undervaluation in 1980, the real exchange rate became strongly overvalued during

1981-83 vis-à-vis its equilibrium level. This was a period when the fixed nominal exchange rate was grossly overvalued in the face of high inflation, general macroeconomic instability, and severe economic distortions. Starting from 1983, extensive steps were taken to liberalize the economy and to improve its overall performance. These corrective measures eliminated the previous overvaluation and led to undervaluation during 1984-90. For the rest of the period 1991-2010, various policy measures led to bouts of macroeconomic stability and instability which affected the direction and degree of misalignment. On the whole, the real exchange rate was found to be overvalued during 1981-83, 1991-92, 1996-99, 2005-08, and 2010, and undervalued during 1980, 1984-90, 1993-95, 200-2004, and 2009.

In all these results, a major factor has been the value of the actual real exchange rate. The misalignment one way or the other detected, might have been influenced to a great extent by the rate at which the nominal exchange rate adjusted to relative prices. From equation 6 above, where the real (effective) exchange rate is defined, with domestic inflation in Ghana remaining consistently higher than trading-partner inflation, failure of the nominal rate to adjust as fast would result in real misalignment. Indeed, the periods of overvaluation—1981-83; 1991-92; 1996-99; 2005-08; 2010—were dominated by macroeconomic instability that must have rendered the actual real exchange rate overvalued. Of course, the equilibrium exchange rate was itself not static, but was influenced by changes in the determinants identified above. Therefore, to have a complete picture of the factors responsible for misalignment one way or the other, one must examine the totality of the evidence to determine the factors driving both the real exchange rate and the equilibrium level in order to ascertain what is pulling them apart. This is quite an extensive exercise that could be undertaken later.

Period	Direction of Misalignment	Degree of Misalignment
1980	Undervaluation	Pronounced
1981-83	Overvaluation	Elevated
1984-90	Undervaluation	Pronounced
1991-92	Overvaluation	Moderate
1993-95	Undervaluation	Moderate
1996-99	Overvaluation	Pronounced
2000-04	Undervaluation	Moderate
2005-08	Overvaluation	Moderate
2009	Undervaluation	Moderate
2010	Overvaluation	Moderate
Jan. 2011-June 2012*	No clear indication*	Negligible*

*Tentative inferences

The determination of exchange rate misalignment in the study extends to 2010 based on available data. Beyond that date, we can make some tentative inferences using exchange rate data available from Bank of Ghana. The data indicates that from January 2011 to June 2012, the bilateral dollar-cedi rate depreciated by about 20%. However, the (trade-weighted) real effective exchange rate depreciated by only 2%. This suggests that nearly 18% of the nominal depreciation of 20% accounted for inflation differential with Ghana's trading partners, leaving real depreciation of only 2%. This study finds "real overvaluation" of about 1.6% as of end 2010 (See the estimation results above). Therefore, the 2% real depreciation that occurred during January 2011- June 2012 just about erased the 1.6% real overvaluation existing as of end

2010. Further, assuming all things equal, in particular that the equilibrium real exchange rate does not change between end-2010 and June 2012, it can be deduced that the sharp nominal depreciation during the period, contrary to expectation that it possibly led to real undervaluation, only restored the real exchange rate to its equilibrium level. By June 2012, there was no significant misalignment one way or the other.

6. Conclusion

The study finds that the equilibrium real exchange rate in Ghana during 1980-2010 is determined by standard "real" or "fundamental" variables. Productivity has both significant long-run impact and short-run impact on the real exchange rate. All the other "real" variables (trade openness, real relative interest rate, government expenditure, terms-of-trade, and foreign reserves) have short-run significant impact on the real exchange rate. The nominal macroeconomic variables (represented by domestic credit and the budget deficit) do not have significant effect on the equilibrium real exchange rate.

The equilibrium real exchange rate follows a declining path during the study period, implying that the combined effect of the fundamental factors depreciating it outweighs the effect of those appreciating it. The speed of adjustment of the actual real exchange rate to the equilibrium level or correction of any misalignment is relatively fast. As much as 97% of any misalignment is corrected within a year. There is clear evidence of misalignment of the real exchange rate one way or the other throughout the entire period. Apart from 1981-83, when overvaluation is strongly indicated, the rest of the period does not indicate a clear trend bias towards overvaluation or undervaluation.

The determination of exchange rate misalignment extends to 2010 based on available data. Beyond that date, tentative inferences from exchange rate data available from Bank of Ghana suggest that from January 2011 to June 2012, the sharp nominal depreciation that occurred restored the real exchange rate to its equilibrium level and that by June 2012, there was no significant misalignment one way or the other.

Following from the determination that the long-run decline of the Ghanaian cedi is influenced by economic fundamentals (that consistently drive the real rate towards its equilibrium level), to stem the tide of depreciation, policy strategy must focus on strengthening the economy's fundamentals, with sustained macroeconomic stability and growth being at the core. The IEA has articulated such corrective policy measures in other papers.

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