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Real Exchange Rate Misalignment in WAMZ Countries

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This paper investigates the potential costs of membership in a monetary union. We quantify the cost by examining the degree of exchange rate variability of WAMZ[2] member countries. We take a closer look at exchange rate variability since 2000 - the run-up period. To put it differently, we examined whether member countries exchange rate variability has increased as they prepare to enter into a monetary union. The main hypothesis to be tested in this paper is: has the preparation to enter into a monetary union led to an increased cost to the zone. In order to address the question, we assess the costs of membership in WAMZ zone using real exchange rate (RER) variability. We use panel data, General Least Squares (GLS) and single equation to estimate real exchange rate misalignment of each country from 1980 to 2005. This allows us to assess the cost of WAMZ membership since the run-up period --2000. Using both real and monetary factors, we assessed which variable affects real exchange rate (RER) variability the most and the behavior of these variables since the run-up period.

The empirical result shows that real exchange rate variability has increased substantially across WAMZ zone in recent years -- 2000 to 2005. We concluded that the road to monetary union has so far imposed high cost to members and it highlights the need for member countries to level the playing field by putting their macroeconomic fundamentals in order before entering into monetary union.

1. Introduction

The widely cost of currency union discussed in the literature is the cost of countries losing independent monetary policy. The implication is that

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[2] WAMZ stands for West African Monetary Zone which consists of The Gambia, Ghana, Guinea, Nigeria, and Sierra Leone.

member countries do not only lose independent monetary policy as a stabilization tool when confronted with economic shocks, but have to give up other revenue generating avenues as they enter into a monetary union.

If the monetary union leads to common market, it implies that all barriers have to be removed which leads to lost of tariff revenue. Similarly, seigniorage revenue that a country generates before entering into a monetary union is either eliminated or reduced. There is also an added cost to be incurred by member countries as they enter into a monetary union. Each country will be required to contribute a certain amount that is to be kept as reserve. Although the main export of the zone is agricultural products, the economies of the zone are diverse. Nigeria, with the largest oil-exporting economy, faces different terms of trade than the rest of the zone. Problems are likely to emerge when economies of different countries with different fundamental structures are to be integrated under one single currency. These different economies range from difference in labor market institutions, preferences of inflation and unemployment, legal systems, growth rates, and fiscal systems and the seigniorage problem.[3]

Although the labor market institutions for the member countries are similar, labor is relatively immobile within the zone. Consequently a shock may affect wages and prices in these countries at different magnitudes, which apparently make it difficult to correct these differences. Countries also have different fiscal systems. This difference causes countries to use different combinations of tax and monetary financing of certain government debts. The tax system in the zone is underdeveloped and the main option government uses to raise revenue is through inflation. This makes it costly to form a monetary union because of the lack of common smoothing devices to level the impact of shock on wages and prices.

The paper is organized in the following manner: In section 2, real exchange rate variability and a survey of the literature are discussed. Section 3 contained the theoretical framework. The data source and methodology employed for the empirical analysis is discussed in section

[3] See De Grauwe

4. Section 5 contains the empirical results. Summary and conclusion is contained in section 6.

2 Literature Review

The era of floating exchange rate is characterized with real exchange rate variability. A large amount of study has documented the deviation of actual real exchange rate (RER) from long run equilibrium real exchange rate. Some earlier papers survey the literature by looking at the sources of real exchange rate variability. Korteweg (1980) investigated the source of RER variability using a group of Organization for Economic Co-operation and Development (OECD) countries. The empirical results show that real exchange rate variability has been influenced by shocks that emerged from both monetary and real variables. Helleiner (1981) surveyed the literature using developing countries. In his study, he separated the sources of real exchange rate variability into external sources and other sources. His findings reveal that even though external sources play an important role in determining exchange rate variability, other sources do have greater influence in other countries. These other sources include among other things such as domestic monetary policy.

Other researchers investigate how the real exchange rate deviates from PPP. Stockman (1983) developed a model to investigate the impact of nominal and real changes on real exchange rate variability. Employing data from a group of 38 developed and developing countries, his findings revealed that variability is greater under a floating regime than under fixed regime. Similarly, Yuravlivker (1982) conducted a study on four developing countries. His results reveal that real exchange rate variability was positively influenced by the instability of the nominal exchange rate.

Degrauwe, Janssens and Lelianert (1984) used cross-sectional data to investigate the effect of inflation and monetary disturbances on real exchange rate variability. Their results support the proposition that an increase in inflation and monetary disturbances increases real exchange rate variability. DeGrauwe and Rosiers (1984) developed a model which added degree of openness of an economy variable in addition to monetary disturbance. The model predicts that both variables positively influence the real exchange rate variability. Their findings supports the

hypothesis that monetary disturbance increases real exchange rate instability. Melvin and Bernstein (1984) surveyed the literature by using only real factors. Using cross-sectional data for 87 countries and regressing bilateral exchange rate variability index against exports and openness, Melvin and Bernstein (1984) found that the two variables significantly influenced exchange rate variability.

Edwards (1986) investigated the potential role of monetary and real factors in explaining real exchange rate variability in certain selected developing countries. He used two indexes of real effective exchange rate variability (short-term and long-term) for 30 countries. In his findings, unstable nominal exchange rate policies reflected high exchange instability in the short-run and unstable terms of trade reflected real exchange rate instability in the long-run. Contrary to other findings, Edwards' (1986) results revealed that both monetary and real factor influenced real exchange rate variability though nominal variability affects the short-wave while real variability factors affect the long-wave instability.

Devarajan and de Melo (1987) evaluate the effect of participation in a monetary union employing a costs and benefits approach using 1960-1983 cross-section and time-series data. Devarajan and de Melo (1987) classified the data into two sub periods: 1960-1973 and 1973-1982, the later sub periods corresponding to floating exchange rates, supply shocks, and greater autonomy in setting monetary policy within CFA zone. Out of eleven classification schemes with the exception of two, CFA Zone countries improved their performance vis-à-vis comparator countries during the 1973-82 periods. The results supported the argument that monetary union imposed discipline which was helpful for adjustment during the period that generalized floating and supply shocks. Devarajan and Rodrik (1991) investigated whether the benefits of currency union outweigh their costs using the CFA zone in Africa. Devarajan and Rodrik (1991) concluded using inflation-output trade off that the CFA zone would have been better off having a floating exchange rate that adjusted to shock than having fixed exchange rate.

Allechi and Niamkey (1994) evaluated the net gains from the CFA Franc Zone membership using partial pool reserve method. Taking into account the costs associated with maintaining operation accounts with the French Treasury, the interest rate cost, and exchange rate risks, their

results reveal more net losers than gainers in the CFA zone. Elbadawi and Soto (1995) contributed to the calculation of long-run real exchange equilibrium and real exchange rate misalignment. Elbadawi and Soto (1995) considered 7 countries including 4 countries from Sub-Saharan Africa[4] (SSA), Chile, Mexico, and India. Elbadawi and Soto's (1995) result of the long-run cointegration equilibrium equation of the RER and the corresponding dynamic error-correction specification strongly corroborate the theoretical model and mostly agrees with the results from previous studies.

3 Theoretical Framework

The models that motivate the measure of real exchange rate RER misalignment stemmed from the work of Edward (1889), Rodriguez (1989), Elbadawi and Soto (1997), Hinkle and Montiel (1999) and Hallerberg (2002). In their work, they employed the concept of intertemporal model of the determinants of RER. Using this framework as a guide will permit us to separate the effects of short and long run determinants of the RER and compute the equilibrium real exchange rate (ERER). In this setting, real exchange rate is defined as the relative price of tradable to non-tradable goods:[5]

$$RER \equiv e = \frac{EP_T}{P_N}$$

where E is the nominal exchange rate, the price of a domestic currency in terms of a foreign currency. In the framework, the observed real exchange rate is further influenced in the short run by certain macroeconomic policy induced shocks that do have an effect in determining the long run RER. In other words, the RER is affected by the fundamentals and policy-induced shifts in its real fundamentals. In the model RER is a function of the following real fundamentals: terms of trade, government spending a proxy for spending in non tradable goods, and openness used a proxy for commercial policy.

[4] The four Sub-Saharan countries considered are Cote d'Ivoire, Ghana, Kenya and Mali

[5] A more traditional but still used relies on the purchasing power parity (PPP) approach. In this approach, the PPP real exchange rate is equal to the nominal exchange rate corrected by the ratio of the foreign price level (p*) to the domestic price level given by $RER = \frac{EP^*}{P}$

From the above equation, either an increase in nominal exchange or an increase in demand on tradable goods will cause the RER to depreciate (RER increase). Conversely, a fall in nominal exchange rate and a fall in prices of tradable goods will cause RER to appreciate (RER decrease). While a depreciation of a country's real exchange rate increases its competitiveness in the world market, an appreciation reduces its competitiveness and decreases the demand for its product which will have an adverse effect in the country's current account balance. RER change as a result of a change in any of the fundamentals or policy-induced shift in the real fundamentals. Any policy that deviate the real exchange rate from its equilibrium value will cause real exchange rate misalignment. Real exchange rate misalignment is defined as sustained deviations of the actual real exchange rate from its long-run equilibrium level.[6] Equilibrium RER (ERER) is defined as the relative price of tradable that, for given sustainable values of other relevant variables such as taxes, international prices, and technology results in simultaneous attainment of internal and external equilibrium. *Internal equilibrium* implies that the nontradable goods market clears in the current period, and is expected to be in equilibrium in future periods. In this definition, it is assumed that this equilibrium exist where unemployment is at it "natural" level. *External equilibrium*, however, is attained when the intertemporal budget constraint that states that the discounted sum of a country's current account has to be equal to zero is satisfied. To put it differently, it is a situation where the current account balance is sustainable to long-run capital flows.[7] As a result, misalignment may arise as a result of policies that are incompatible with the fundamentals.[8]

Empirical evidence shows that an increase in terms of trade and government spending leads to RER appreciation. However, uncertainty pertaining to the effects of terms of trade arises as a result of the presence of wealth effect of an improvement in terms of trade which tends to expand the demand for non-traded goods and thus raises the prices of non-traded goods appreciating the RER and a substitution effect which works in the opposite direction by lowering the cost of imported inputs in the production of non-traded goods. Similarly,

[6] In a purchasing power parity environment, the equilibrium real exchange is constant
[7] See Edwards (1989)
[8] Edwards and Elbadawi stated that in a system of fixed-pegged nominal exchange rates, expansionary fiscal and monetary policies can result to overvaluation.

government expenditure leads RER to appreciate because of the possibility that government spends more on non-traded goods than on the private sector.[9] As noted earlier, the equilibrium real exchange rate is obtained when both internal and external balance are attained at the same time. The equilibrium real exchange rate is given as

$$e^* = \sigma' F_t$$

where F_t is a vector for the fundamentals and σ' a vector for coefficients of the parameters of the fundamentals. To obtain the fundamental vector coefficients, the actual (observable) RER is estimated which a function of both real and transitory variables is given as

$$e = \sigma' F_t + \gamma' T_t + \varepsilon_t$$

where, F_t is the vector of fundamentals, T_t is a vector for transitory variables, and ε_t is a disturbance term with mean zero. Whenever e^* (ERER) differs from e (actual) it implies real exchange rate misalignment. If e^* is greater than e , it implies overvaluation and if e^* is less than e, it implies undervaluation. The data source and methodology employed for the empirical analysis is discussed in the next section.

4 Data Source and Methodology

4.1 Data Source

Most studies on real exchange rate variability used bilateral real exchange rates. To construct bilateral exchange rates we collected annual data on price levels from the World Bank's *World Development Indicators (WDI) 2005 CD-ROM* and the normal exchange rates are sourced from the IMF's *International Finance Statistics 2005 CD-ROM*. For real exchange rate determinants, data on exports, imports, output, output per capita, terms of trade, trade balance, monetary growth, government spending, and inflation are sourced from World Bank via *West African Monetary Institute (WAMI)*

[9] See Elbadawi and Soto (1997)

4.2 Methodology

The sample covers 1980 to 2005 based on the availability of data. Observations on all variables were available for each year. From the data we generate RERs and their determinants. For openness, we followed the literature and measured it as $(\frac{Exports + \text{Im } ports}{GDP})$ to proxy for trade policy. Ratio of government expenditure to output $(\frac{Gov.spending}{GDP})$ is used as a proxy for composition of government expenditure spending. The terms of trade (TOT) measure defined as the ratio of exports to import prices. The real GDP per capita growth is used as a proxy for real productivity shocks. The ratio of money to output $(\frac{M2}{GDP})$ is used as a proxy to monetary growth instability. Domestic inflation as a proxy to monetary policy and variability of inflation is also included in the regression. All things being equal, a more variable domestic inflation is expected to result in higher exchange rate instability. Similarly, studies have shown that higher inflation level corresponded to higher variability of the real exchange rate.

To assess whether a country's real exchange rate deviates from its run long equilibrium has been a difficult task.[10] The Purchasing Power Parity (PPP) is used to calculate misalignment. An alternative version is used in the literature which takes into account of changes in the "fundamentals."[11] Though authors differ in the number of fundaments use, the basic "fundaments" included terms of trade, output growth, degree of openness of a country to international trade, and level of government spending. We followed Edward (1988), Baffes, Elbadawi, and O'Connell (1997), and Goldman-Sachs (1997) and used a single equation methodology to assess the degree of misalignment in WAMZ zone.[12] To proceed with the single equation methodology, we first calculated the exchange rate. The real exchange rate defined as the

[10] Attempt to calculate misalignment make use of version of purchasing power parity (PPP). Though simple to apply, it has certain deficiencies in that it does not take into account the changes in the fundaments in determining equilibrium real exchange rate.

[11] An example of these methods is the single equation which defines real exchange rate as the ratio of price of tradable to nontradable goods.

[12] Misalignment occur as a result certain policies which are incompatible in maintaining internal and external balance

nominal exchange rate deflated by a ratio of domestic to foreign price levels as

$$e \equiv s + p^* - p = \ln(SP^*/P) \quad (1)$$

where *e* is the log of real exchange rate, *s* is the log of nominal exchange rate which is defined as units of local currency per foreign currency unit and *p* and *p** are the log of the price levels with asterisks denoting foreign quantities. In other words, the real exchange rate can be written as the product of nominal exchange rate and GDP deflator of the foreign country divided by GDP deflator of the home country:

$$e = \frac{S.GDPdeflator_{foreign}}{GDPdeflator_{\text{home}}}$$

where S the nominal exchange rate, $GDPdeflator_{foreign}$ is the GDP deflator of the foreign country and $GDPdeflator_{\text{home}}$ is the GDP deflator of the home country.

In the study we considered bilateral exchange rate instead of multilateral exchange rate and the chosen foreign country is the U.S.[13] This is because the zone members are mainly exporters of primary produce, the prices of which are quoted in U.S dollars in the world market. In addition, bilateral exchange rate is easier to calculate than multilateral exchange rate. In order to compute bilateral exchange rate, all that is needed is a single nominal exchange rate and price indices from the two countries. Any change in U.S dollar vis-à-vis a member country currency will have significant impact in the country's competitiveness level in the world market for her exports. The graphs for bilateral real exchange rate for the zone member currency vis-à-vis the U.S dollar are shown in Figures 1a through 1e. Any change in RER would have an important effect on individual WAMZ member countries. Assuming that

$$v_n \equiv e \quad (2)$$

We follow Edward (1989), and decompose variability of real exchange rate into monetary and real structural factors as

$$\log v_n = \alpha_0 + \sum_i \beta_i \log M_{in} + \sum_j \gamma_j \log X_{jn} + \varepsilon_n \quad (3)$$

[13] A bilateral real exchange rate is the price ratios between two countries while a multilateral real exchange rate includes a weighted measure of nominal exchange rates and price indices for several foreign countries.

where v_n is an index of real exchange rate variability for country *n*, α_0, β_i, and γ_j are parameters, the m_{in}'s represent monetary sources of RER variability, x_{jn} are the real or structural sources of RER variability and ε_n is the error term. An expanded linear version of the above equation can be written as

$$\log v_n = \alpha_0 + \beta_1 \log TOT + \beta_2 \log Open + \beta_3 TradeBal + \beta_4 Govt + \beta_5 \log rGDP + \gamma_1 \log m2GDP + \gamma_2 \log \inf + \gamma_3 \log S + \gamma_4 WAMZ + \varepsilon_n \quad (4)$$

From the above variability of RER, "permanent" determinants include terms of trade (TOT), openness (Open), trade balance (TradeBal), government spending (Govt) and real Gross Domestic Product per capita (rGDP). Measures of openness, government spending, and trade balance are ratio to GDP. The variability of RER "transitory" determinants includes money supply shock (m2GDP), average domestic inflation (inf), nominal exchange rate (S), and a dummy variable monetary union (WAMZ). It captures monetary union impact on real exchange rate variability. In other words, it shows the effect of preparation for member countries has on real exchange rates for member countries since 2000 - the run-up period. The vector coefficients for the real or "permanent" and "transitory" components are $\beta = (\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5)$ and $\gamma = (\gamma_1 + \gamma_2 + \gamma_3 + \gamma_4)$ respectively. In theory, the monetary or "transitory" components play no role in determining the long run variability in real exchange rate. While the term α_0 is the country-specific intercept, ε_n is the error term with mean zero. The dependent variable- $\log v_n$ is an index of real exchange rate variability for country *n*. $\log TOT$ is variability of terms of trade, *Open* Openness index, *TradeBal* Trade balance index , $\log S$ index of instability of the nominal rate with respect to the U.S. dollar, $\log m2GDP$ index of instability of domestic monetary policy, $\log \inf$ index of instability of inflation, $\log rGDPgrowth$ index of instability of real GDP growth and *WAMZ* -- a dummy which takes a value 1 for the years 2000 to 2005 and 0 for other years.

5 Empirical Results

The empirical results obtained from the simulation of the real exchange rate variability equations using General Least Squares (GLS) method. The estimations were performed for both short-term and long-term real exchange rate variability using annual data for the WAMZ members for the period 1980-2005. As prior, it would be expected that the real factors would have an impact in the long-term real exchange variability while the monetary factors have an important influence in the short-term real exchange rate variability.

Tables 1 through 3 contained the real exchange rate variability information for 1980-2005, 1980-1999, and 2000-2005 respectively. Table 4 tabulated the real exchange rate instability using General least square (GLS). Since we have included other monetary measures, we introduced them in the equation one at a time. The results obtained are quite appealing. It is found that the real factors have an important role in determining the long-term real exchange rate variability even with the presences of other monetary factors. While the coefficients of terms of trade, trade balance, government spending and real GDP growth are negative, the coefficient of openness is positive. These coefficients have the same signs even when WAMZ dummy is included. The openness variable remained positive and statistically significant.[14] The main source of explanation of real exchange rate variability across countries during this time period is instability of the countries' openness which remained positive and significant in all equations where it was included. While terms of trade and government spending variability coefficients are negative and statistically significant, the trade balance and real GDP growth though have negative signs are statistically insignificant.

When the WAMZ dummy is added, it does not change the trust of the results. The coefficient of WAMZ dummy have a positive sign and statistically significant. With the exception of nominal exchange rate variability, the rest of the monetary factors remained statistically insignificant when they are all included in the regression equation.[15] However, when the monetary factors are introduced one at a time, both

[14] This is contrary to previous results (Edward (1986)) where openness coefficient was never significant.

[15] The monetary factors are nominal exchange rate, monetary growth, and domestic inflation. The coefficient of nominal exchange rate is positive and statistically significant.

the coefficients of nominal exchange rate (a proxy of the nominal exchange rate policy) and domestic inflation instability remained positive. The nominal exchange rate instability variable remained statistically significant with and without WAMZ dummy. However, the domestic inflation instability is statistically insignificant. These results agreed with that of Edward (1986).

Monetary growth instability coefficient showed a negative sign and is statistically significant. The sign of the coefficient of monetary growth does not change even when other transitory variables are included. While the addition of nominal exchange rate instability lowers the absolute value of the coefficient of the monetary growth, the domestic inflation variability increases the absolute value of the coefficient of the monetary growth. Moreover, the absolute value and significant level of the monetary growth variability increases when WAMZ dummy variable is included in the regression. The finding is in line with the theory and previous results[16] that monetary factors do not have much influence in long-term variability of real exchange rate when all permanent and transitory factors are included at the same time in the regression. The results revealed that monetary growth instability has significant impact in determining long-term real exchange rate when the transitory factors are included one at a time.[17] A caveat is order: when the monetary growth instability enters with either the nominal exchange rate or domestic inflation rate instability with the real term openness, it is statistically significant at a conventional level but have a positive and negative sign respectively.

The short-term real exchange rate variability is also assessed. Due to lack of quarterly data for the countries, short-term real exchange rate variability specification and yearly data are used to assess short-term real exchange rate variability. The results are very interesting and are quite different from those obtained in long-term real exchange rate variability. The coefficients of monetary factors instability shown opposite signs compared to the long-term real exchange rate. As expected, in the short run the monetary factors play a more prominent role in explaining real exchange rate variability. The coefficients of

[16] See Edward (1986)
[17] Monetary growth instability coefficient though negative but become insignificant when nominal exchange rate instability is added in the regression.

monetary growth instability turned out positive, large, and statistically significant. The coefficient of nominal exchange rate instability though remained positive but turned out larger and statistically significant. The domestic inflation instability coefficient show negative sign but remained statistically insignificant. The coefficient of WAMZ dummy though positive is statistically insignificant in the short-term. The implications of the result of short-term real exchange rate variability implies that countries can meaningfully address their exchange problems in the short-run by pursuing more stable nominal exchange rate and monetary policies.

The coefficients estimates obtained from equation 4, is used to construct actual RER, equilibrium RER. To construct the actual RER and equilibrium RER for each period, we take the fitted values from short-term and long-term specification respectively and insert them into the regression equations. Since equilibrium RER is modeled as a function of real variables and actual RER as a function of both real and monetary variables, we used the actual values for the determinants to calculate RER. To compute the degree of RER misalignment (MIS), the actual RER is subtracted from the equilibrium RER. If the equilibrium RER is greater than actual RER, it implies that the currency of that particular country in that period is overvalued. Conversely, if equilibrium RER is less than the actual RER, it implies that the domestic currency is undervalued.

The graphical representation for the two series for each country is shown in figures 2a through 2e. As seen from the figures, all WAMZ members show to some extent an overvaluation of the real exchange rate in the period from 2000 to 2005. The actual RER is always below the equilibrium RER. The average percentage overvaluation for each country in the zone over the period 1980-2005, 1980-1999, and 2000-2005 is tabulated in table 5. Though each country show RER overvaluation, the magnitude differed from one country to the other Nigeria showed an average increase of 58.4 percent while Ghana indicated 29.8 percent increase. Tables 5 shows the average percent increased in overvaluation for each country. Again, Nigeria recorded the highest average percentage increased in RER overvaluation in the entire zone. Though there are substantial percent increased in average RER overvaluation in the zone, Ghana shown a significant undervaluation from (1980-1999) to (1980-2005) and from (1980-1999) to (2000-2005).

The rest of the zone members show a significant percentage increase in RER overvaluation from (1980-1999) to (2000-2005).

The empirical results indicate that an increase in trade liberalization policy leading to ERER depreciation (an increase in RER). This gives the zone a competitive advantage in the world market for the zone's exports. It also supports the proposition that an increase in openness results in the substitution of consumption from the non-traded sector to the traded sector, leading the ERER to depreciate. However, improved terms of trade, trade balance, real GDP growth, and an increased in government expenditure leads to RER to appreciate (a decrease in the LRER).

6 Summary and Conclusion

The empirical result shows that real exchange rate variability has increased substantially across WAMZ zone in recent years -- 2000 to 2005 (since the run-up period). The degree of variability of the real exchange rate, however, is uneven across the zone. While Ghana showed a decrease in variability, the rest of the zone showed an increased. Nigeria and Guinea indicated the highest percent variability increased almost doubling the zone average. The implication is that the increase in misalignment since 2000 --the run-up period means an increase in cost associated with entering into monetary union. The findings reveal that misalignment has increased since 2000 --the run-up period supports the null hypothesis. In addition, terms of trade, trade balance, and money supply percent of GDP are negatively correlated among member countries (see table 4). Nigeria faces different terms of trade and trade balance with the rest. The variation of average RER overvaluation of the zone couple with negative correlations of certain structural variables revealed that the zone does not constitute an optimum currency area.

The unanimity rule though imposed discipline, comes with cost due to the amount of time that might be wasted and the possibility of major decisions and operations of the supranational bank been politicized. In quantifying some of these costs, we concluded that the road to monetary union has so far imposed high cost to members and it highlights the need for member countries to level the playing field by putting their macroeconomic fundamentals in order before entering into monetary

union. Given the trend of RER overvaluation of the zone since the run-up period, it is at a serious disadvantage compared to its comparators countries in the world market. Such a trend must be addressed otherwise it can have serious consequences.[18]

Table 1: Real exchange rate variability in WAMZ Zone annual average 1980 - 2005

Country	Period	Mean 2000=100	Variance	Coefficient Variance	Minimum	Maximum
Gambia	1980-2005	87.08	523.96	0.363	47.81	138.28
Ghana	1980-2005	50.64	738.85	0.360	4.75	100.61
Guinea	1980-2005	69.25	621.45	0.367	23.96	117.93
Nigeria	1980-2005	87.26	997.95	0.478	24.31	146.87
Sierra Leone	1980-2005	90.79	613.30	0.367	45.87	143.08

Sources: The raw data for all countries used to construct these indexes were obtained from IFS and WAMI.

Table 2: Real exchange rate variability in WAMZ Zone annual average 1980 - 1999

Country	Period	Mean	Variance	Coefficient Variance	Minimum	Maximum
Gambia	1980-1999	76.61	130.78	0.33	47.81	90.97
Ghana	1980-1999	40.08	414.53	0.36	44.85	64.48
Guinea	1980-1999	58.09	236.30	0.33	64.48	86.36
Nigeria	1980-1999	87.34	1,260.38	0.43	24.31	146.87
Sierra Leone	1980-1999	86.07	690.57	0.35	45.88	143.08

Sources: The raw data for all countries used to construct these indexes were obtained from IFS and WAMI.

[18] It should be noted however that this may not necessarily be cost since member-countries need to address their macroeconomic fundamentals in order to be compliance with criteria outlined in chapter 2. Some of these costs may dilute eventually once a country satisfies these criteria.

Table 3: Real exchange rate variability in WAMZ Zone annual average 2000 - 2005

Country	Period	Mean 2000=100	Variance	Coefficient Variance	Minimum	Maximum
Gambia	2000-2005	122	221.1	0.414	100	138.28
Ghana	2000-2005	85.83	186.95	0.298	68.64	100.61
Guinea	2000-2005	106.46	49.8	0.433	99.48	117.93
Nigeria	2000-2005	87.06	200.26	0.584	62.96	100
Sierra Leone	2000-2005	106.53	56.13	0.384	95.26	113.28

Sources: The raw data for all countries used to construct these indexes were obtained from IFS and WAMI.

Table 4: Real exchange rate instability – 1980 - 2005 (General Least Squares)

Const	2.93	2.53	4.37	3.04	1.83	3.68	5.04	1.26	0.67	2.05	1.93
	(5.9)	(2.01)	(3.12)	(2.11)	(1.38)	(3.25)	(4.26)	(3.44)	(2.1)	(5.0)	(6.7)
LNER	0.071	0.072		0.05	0.08				0.09	0.1	0.12
	(5.8)	(5.73)		(2.65)	(5.76)				(6.3)	(4.8)	(7.7)
Ltot	-0.44	-0.42	-0.54	-0.42	-0.42	-0.31	-0.58				
	(4.7)	(4.16)	(4.46)	(3.84)	(3.82)	(2.83)	(5.21)				
LOpen	0.73	0.73	0.74	0.82	0.76	0.73	0.77	0.86	0.62		
	13.19	(12.27)	(10.98)	(10.1)	(9.76)	(10.10)	(9.98)	(12.1)	(8.8)		
Tbal(-1)				-0.01	-0.01	-0.001	-0.003				
				(2.43)	(2.25)	(0.28)	(0.95)				
LGovt				-0.42	-0.39	-0.40	-0.31				
				(3.94)	(3.63)	(3.60)	(2.52)				
LGDP		0.06	-0.14	0.17	0.31	0.02	-0.06				
		(0.34)	(0.69)	(0.85)	(1.65)	(0.12)	(0.31)				
LM2				-0.08	0.09			-0.24	0.21	0.64	0.68
				(0.65)	(1.01)			(2.4)	(2.3)	(5.7)	(8.93)
LDinf			0.02	0.02	0.01			0.02		-0.02	-0.02
			(0.52)	(0.58)	(0.35)			(0.6)		(0.7)	(0.64)
WAMZ				0.19		0.32				0.04	
				(2.06)		(5.09)				(0.44)	
R^2	0.95	0.95	0.92	0.97	0.97	0.98	0.96	0.76	0.94	0.98	0.98
F	846	631	344	361	433	846	524	127	648	1313	1727

Note: Regressed is the log of RER; the numbers in parentheses are *t*-statistics. R^2 is the coefficient of determination and *F*- statistics for the regression as a whole

Table 5 Average RER Misalignment

Country	1980-2005	1980-1999	2000-2005	(1980-1999) (1980-2005)	(1980-1999) (2000-2005)
Gambia	36.30%	33.20%	41.40%	9.00%	25.00%
Ghana	36	36.1	29.8	-14.83	-17.43
Guinea	36.7	33	43.3	11.05	31.23
Nigeria	47.8	42.6	58.4	12.41	37.09
Sierra Leone	36.7	34.5	38.4	6.48	11.4

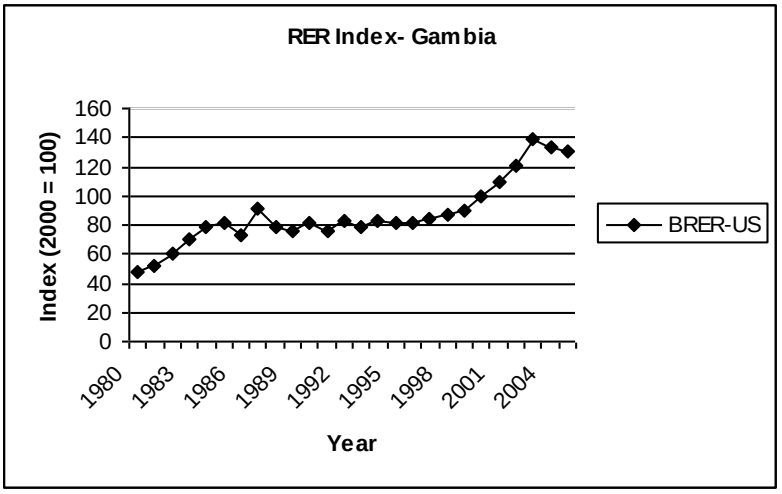

Figure 1a: Real exchange rate for Gambia

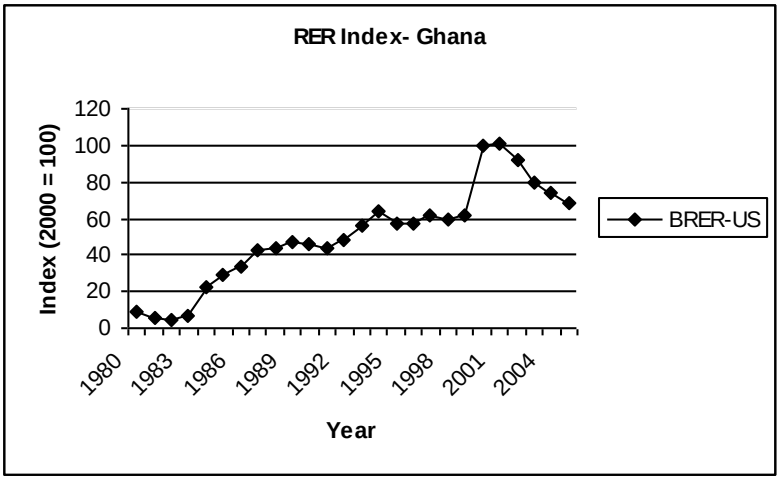

Figure 1b: Real exchange rate for Ghana

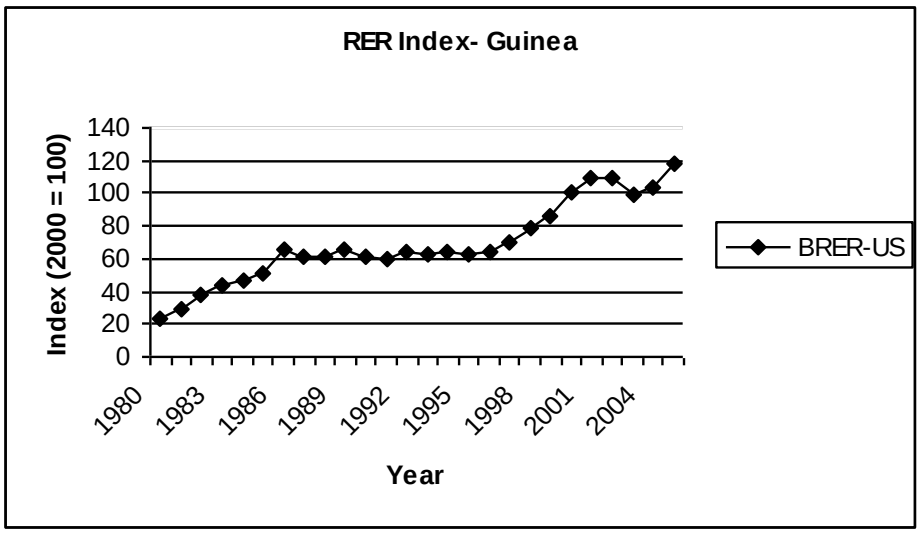

Figure 1c: Real exchange rate for Guinea

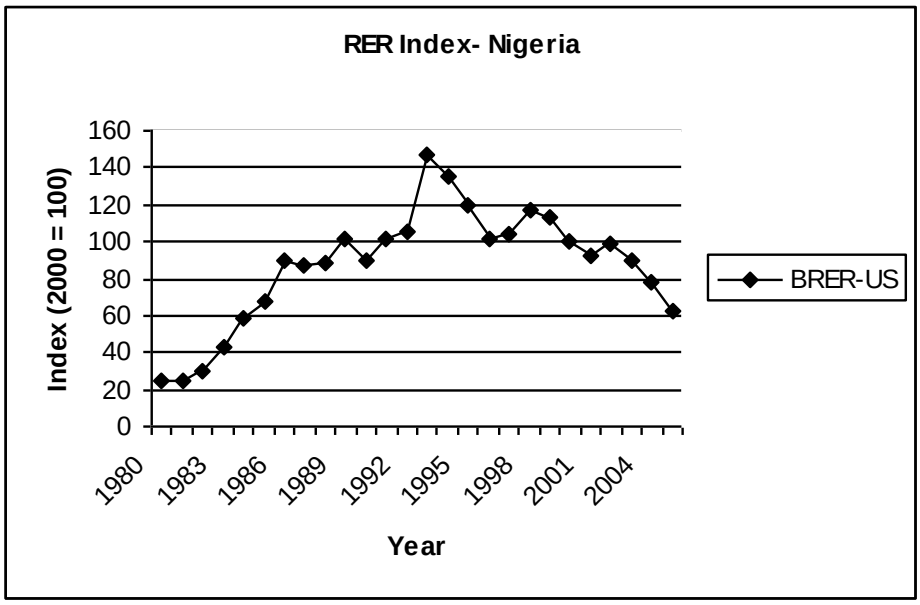

Figure 1d: Real exchange rate for Nigeria

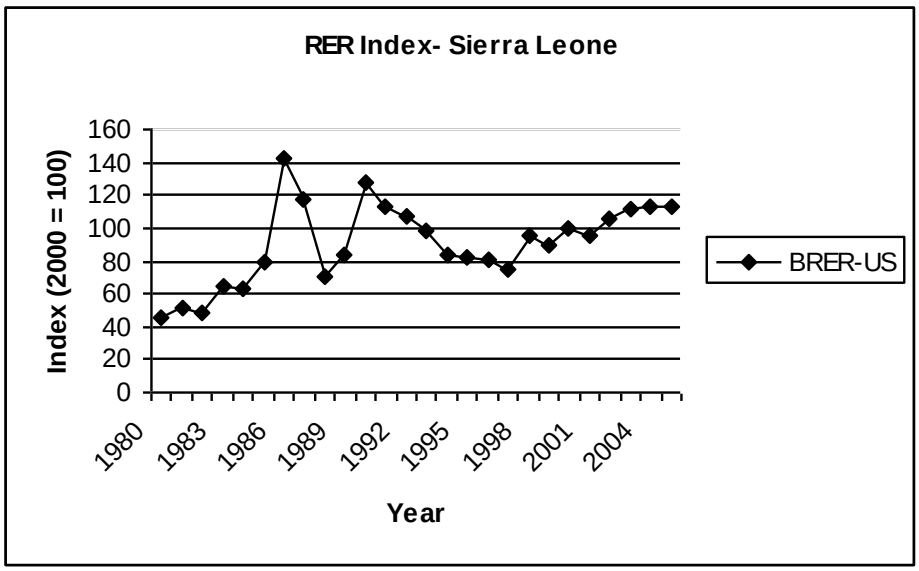

Figure 1e: Real exchange rate for Sierra Leone

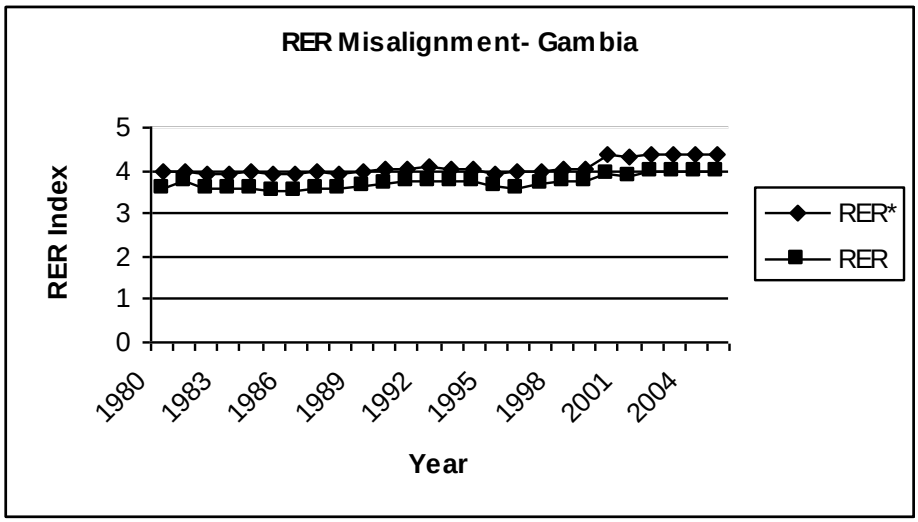

Figure 2a: Real exchange rate misalignment – Gambia

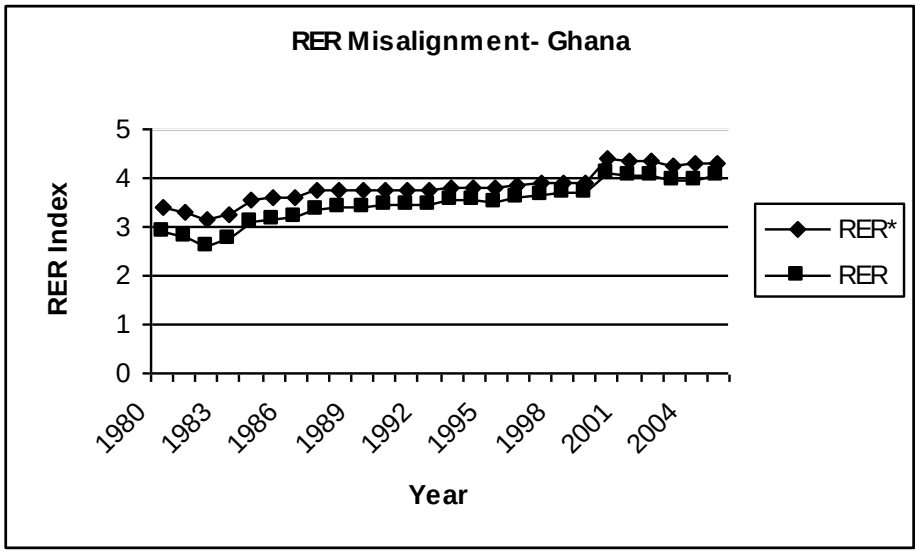

Figure 2b**:** Real exchange rate misalignment - Ghana

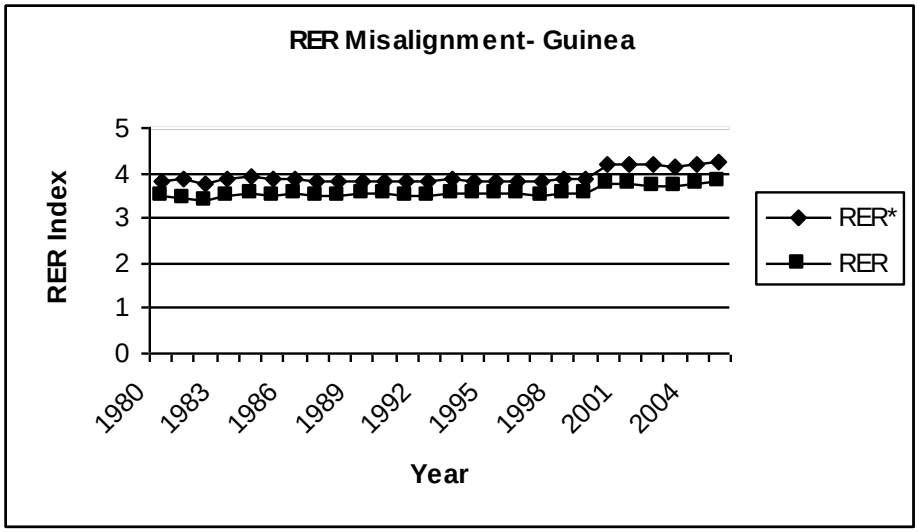

Figure 2c: Real exchange rate misalignment – Guinea

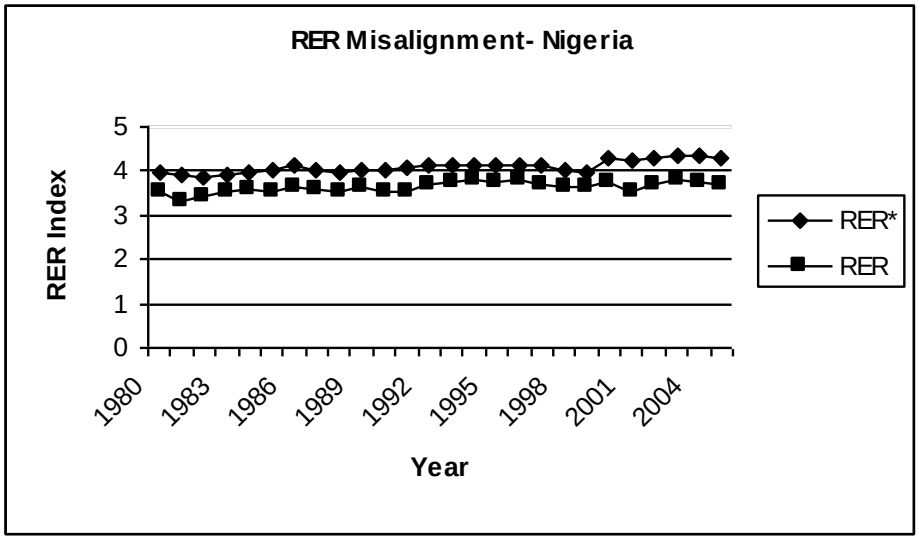

Figure 2d: Real exchange rate misalignment - Nigeria

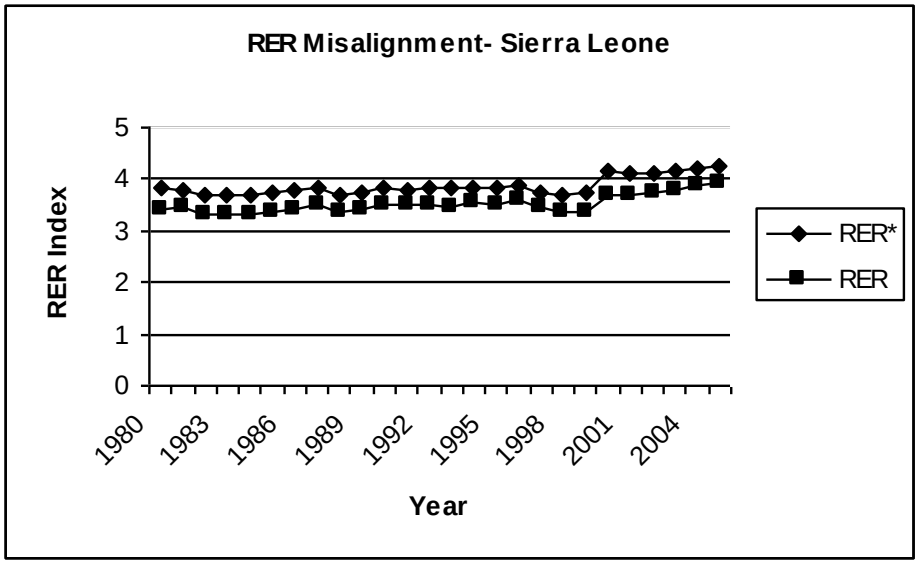

Figure 2e: Real exchange rate misalignment – Sierra Leone

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