# Real exchange rate fundamentals economics essay

**Economics** 



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## Abstract

In this study, we estimate the real determinants of the cedi exchange rate using a variant of Macdonald's (1998) behavioural equilibrium real exchange rate (BEER) model. We estimated the model using the Johansen's procedure that takes into account of the possible structural break in the post-1983 reforms. We found that in the long-run, the real exchange rate is determined by aid inflows (and other forms of capital inflows), government consumption, openness, and terms of trade. The long-run effect of aid inflows on real exchange rate is quantitatively smaller than that of government consumption spending. In addition, the 1983 reforms have had a depreciating effect on the real exchange rate, implying increased external competitiveness. In the short-run, however, deviations from equilibrium are caused by changes in the BoG's NFA holdings, government consumption spending, openness and nominal exchange rate. One policy implication of this finding is that Bank of Ghana must remain vigilant about the possible Dutch Disease effects of capital inflows, especially as the newly discovered oil revenue starts flowingJEL Classification: F31, F35, O11, O55Keywords: Real Exchange Rate, Real Exchange Rate Determinants, Economic Reforms, Cointegration, Capital Flows

## Introduction

Since the adoption of the Economic Recovery Programme (ERP) in 1983, the real effective exchange rate (REER) in Ghana has generally depreciated, in line with the objective of the programme. In addition, the dynamics of the https://assignbuster.com/real-exchange-rate-fundamentals-economics-essay/

real exchange rate also exhibits some important swings and volatility, especially since the 1990s (see Figure 1). More recently, in 2000, the REER had depreciated sharply following the large negative terms of trade and the collapse of the cedi in 1999-2000. Since then, however, the real effective exchange rate has been appreciating, despite the depreciation of the nominal effective exchange rate (NEER). Understanding the underlying empirical drivers of these movements in the REER is, undoubtedly, important for Ghanaian policy makers for several reasons. First, Ghana had undergone significant structural changes since the inception of the ERP in the mid 1980s, which may have affected the dynamics of the real exchange rates. In addition, the IMF conditionality that accompanied these reforms places a floor on the Net Foreign Asset of the Bank of Ghana (BOG) and a ceiling on its Net Domestic Assets (NDA) could have a significant effect on the behaviour of the real exchange rate. Second, because Ghana depends on a few primary commodities and (volatile) foreign aid inflows for foreign exchange, disequilibrium movements in real exchange rates can be very costly to production and consumption[1]. Moreover, recent literature has shown that large recurrent misalignments (and volatility) of real exchange rate leads to lower growth rates, current account deficits as well as currency and financial crises in developing countries (see for instance, Johnson et. al., 2007). In addition, movements in real exchange rate also affect internal production and consumption allocations between traded and non-traded good. Therefore, the guestion of what determines the REER in Ghana is especially fundamental. Previous empirical studies on the determinants of the real exchange rate in Ghana have ignored the possible effects of the 1983 economic reforms as well as the effects of the changes in the BOG's https://assignbuster.com/real-exchange-rate-fundamentals-economics-essay/

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behaviour in NFA holding (see for instance, lossifov and Loukoianova, 2007, Nkusu, 2004, Opoku-Afari, et. al 2004, and Sacky, 2001). In this study, we are going to investigate the empirical determinants of the long-run and short-run behaviour of the Ghanaian real exchange rate in Ghana. Secondly, we will investigate the effect of the 1983 economic reforms as well as the effects of the changes in the BOG's NFA. The rest of the paper is organised as follows: section two presents a brief review of the previous research, Section 3 describes the research methodology. Section 4 presents the empirical results while section 5 concludes the paper. Figure Real Effective Exchange Rate and Nominal Effective Exchange Rate for Ghana

## **Literature Review**

The substantial changes in both real and nominal exchange rates of the U. S. dollar, the pound sterling and the yen in the past 25 years have generated a considerable interest in exploring the factors that may be able to explain these movements. The general question the resultant literature attempts to answer is whether exchange rates are driven, in a systematic fashion, by fundamental economic forces or are random walks. One strand of this literature identifies a small set of economic variables that explain these movements and attempts to ascertain the extent to which the exchange rate is misaligned. Such studies, on the equilibrium exchange rate, include those of Edwards (1988, 1989), Elbadawi (1994), Macdonald (1998), MacDonald and Stein (1999), Baffes et al. (1999) and Williamson (1994). There are two major approaches to the analyses of equilibrium real exchange rate and its misalignment. First, there is the macroeconomic balance approach, which is attributable to works of Williamson (1994). In this approach, the equilibrium

real exchange rate, known as a fundamental equilibrium exchange rate (FEER), is calculated as that real equilibrium obtained when the economy is operating at full capacity and sustainable current account position (see also Israd and Farugee, 1998). The second approach is popularised by Clark and MacDonald (1998, 2000), and involves estimating a model of the real exchange rate behaviour directly. This approach is called the behavioural equilibrium real exchange rate (BEER). The task in this approach is typically to estimate the extent of misalignment, which is calculated as the deviation of the actual real exchange rate from the estimated equilibrium values. These equilibrium values are given by the relationship between the real exchange rate and its economic fundamentals (see MacDonald, 1998). The few empirical studies on the real exchange rate determinants in Ghana include Younger (1992), Sackey (2001), Opoku-Afari, et. al (2004) and lossifov and Loukoianova (2007). A common question in most of these studies attempt to resolve relates to the Dutch disease effect of capital flows, where capital inflows lead to real appreciation of the domestic currency. Early empiric support for this hypothesis in Ghana is provided by Younger (2002). He argues that excessive aid inflows to Ghana have led to macroeconomic management problems, and loss of international competitivenessOpoku-Afari, et. al (2004) uses the vector autoregressive techniques (VAR) to model the long-run equilibrium real exchange rate for Ghana. Their major findings are that capital flows only have appreciating effect in the long-run, but have no effect in the short-run. in addition, technological change, exports and terms of trade are found to have a depreciating effect on the real exchange rate in the long run. lossifov and Loukoianova (2007) use vector error correction model to estimate the BEER https://assignbuster.com/real-exchange-rate-fundamentals-economics-essay/

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for Ghana for the period 1984-2006 using quarterly data. They found that in the long run, real exchange rate is determined by real GDP growth, real interest rate differentials and the real world prices of Ghana's main export commodities. On the basis of these determinants, they estimated the real misalignment of the real rate over the period.

## Methodology

### The BEER Model

To model the real exchange rate, this paper follows the BEER methodology of Clark and MacDonald (199). One advantage of this approach is that it is relatively simple, because it avoids most of the difficult and arbitrary choices that are involved in the alternative FEER approach. In addition, it allows a direct examination of the effects of certain variables and policies (see for instance, Elbadawi, 1994). The BEER methodology involves the estimation of a reduced-form equation that explains the behaviour of the real exchange rate over the sample period. In the spirit of BEER, the general form of the model can be represented as (all variables are in natural logarithm): et =  $\beta$ 1`F1t +  $\beta$ 2`F2t +  $\tau$ `Tt +  $\epsilon$ t1where et is the real (effective) exchange rate, F1 and F2 are respectively vectors of economic fundamentals that affect the real exchange rate in the long-run and in the medium-term respectively. Tt is a vector of factors that have transitory effect on the real exchange rate, such as changes in the NFA of the BoG, temporary changes in aid inflows, etc.  $\beta$ 1,  $\beta$ 2 and  $\tau$  are the respective reduced-form coefficients, and  $\epsilon$ t is the random error term. For empirical purposes, cointegration analysis provides a convenient way of estimating long-run equilibrium, while the corresponding error-correction model (ECM) can be used to estimate the short-run

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dynamics. In addition, it is possible to assess the extent of misalignment over the sample period, given the equilibrium estimated. However, the magnitude of the estimates of such misalignment will be contingent on the concept of equilibrium adopted. Although the real exchange rate literature is replete with different concepts of equilibrium, we follow Clark and Macdonald (1998) to estimate a BEER. Within the BEER approach, two concepts of equilibrium are distinguishable: the current equilibrium and the permanent equilibrium. The current equilibrium refers to the equilibrium value of the real exchange rate when its fundamentals are at their current values. The permanent equilibrium, however, is the equilibrium values of the real exchange rate when all the fundamentals are set at their sustainable or desired levels. This is the case where the equilibrium rate is achieved when all the fundamentals are in themselves at sustainable or long-run equilibrium levels. This latter concept of equilibrium is comparable to the FEER of Williamson (1994)[2]. The distinction allows us to estimate current as well as total misalignments. Current misalignment (cm) can be computed as the difference between the actual real exchange rate (et) and the real exchange rate given by the current values of all its economic fundamentals, Ft: cmt = et -  $\hat{e}t = et - \beta 1$  F1t +  $\beta 2$  F2t +  $\tau$  Tt +  $\epsilon t 2 orcmt = et - BEERt = et \beta$  Ft3where are the vectors of long-run parameters from the cointegration analysis, and F is the vector of the fundamentals at their current values. Total misalignment (tm) is the difference between the actual real exchange rate and the real exchange rate given by the sustainable or long-run values of the economic fundamentals (and).

## $tmt = et - \beta 1F1t - \beta 2F2t4$

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or5where is the set of fundamentals set at their permanent levels, the choice of which we will consider in the next section. The long-run coefficients,  $\beta$ s, will be estimated using the Johansen Maximum Likelihood approach to cointegration analysis, and will be briefly discussed later.

## **Real Exchange Rate Fundamentals**

Foreign Aid Inflows (AIDY): Theoretically, permanent increases in foreign aid inflows tend to appreciate the real exchange rate by raising the demand for non-tradable goods, and hence their prices, as the proceeds are spent domestically[3]. The empirical effect of foreign aid inflows on the real exchange rate in reforming SSA countries has been contentious. Several studies have found that instead of leading to real appreciation, aid inflows in some SSA reforming countries, including Ghana, have led to real depreciation (see, IMF, 2005; Nyoni, 1998; and Sacky, 2001)Total Capital Inflows (RBAL): Like aid inflows, an increase in capital inflows is expected to lead to real appreciation since in Ghana. These flows are likely to raise domestic absorption and shift the composition of potential GDP towards nontraded goods (see Baffes et al., 1997). In our model, therefore, total capital inflows are used as an alternative measure to aid inflows. We measure total capital inflows as the difference between imports and exports plus increases in the NFA of the banking sector as a ratio of GDP. It measures the impact of total capital inflows (AID, remittance inflows and FDI). Government Consumption (GCY): Because government consumption spending tends to be biased towards non-tradables, it is thought to have effects on the real

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exchange rate. According to Frenkel and Razin (1996) there are two channels through which government consumption spending influences the real exchange rate and private spending. The first is the resource withdrawal channel, in which the real rate appreciates if the proportion spent on the non-tradable goods is higher, and depreciates when it is relatively lower. In the consumption-tilting channel, If government consumption complements private consumption, then increases in government spending tilts total consumption towards non-tradables and appreciates the real exchange rate (Balvers and Bergstrand, 2002). Terms of Trade and Commodity Prices: Terms of trade measures the relative price of exports to imports and indicates the effect of foreign demand and supply on the tradable sector. Improvements in the terms of trade has both income and substitution effects: the income effect leads to appreciation of the real exchange rate as aggregate spending increases including on non-tradables thereby raising their prices. The substitution effect is due to the decrease in relative price of imported goods and hence leads to real depreciation. Openness to Trade: The degree of openness or distortions to trade and the extent of trade liberalisation are considered to have an effect on the real exchange rate. Trade-liberalising reforms that increase openness tend to depreciate the real exchange rate. An increase in openness, such as a reduction in a tariff and other restrictions to trade, leads to a decline in the domestic price of imported goods leading to excess demand for imported goods and reduces the demand for non-tradables. As a result, the real exchange rate depreciates so as to restore equilibrium in the non-tradable goods' market. Increases in openness are therefore expected to lead to real depreciation (see lossifov and Loukoianova, 2007; Nyoni, 1998; Opaku-Afari, 2004 and https://assignbuster.com/real-exchange-rate-fundamentals-economics-essay/

Baffes et al 1997, for instance). Following the literature, we constructed alternative measures of the degree of openness: imports plus exports as percent of GDP all in constant prices (Open1), current imports as percent of GDP (Open2) and imports as percent of domestic absorption (Open3). Net Foreign Assets of the Bank of Ghana: Changes in the Net Foreign Assets of the BoG (NFABOG) affect the real exchange rate only in the short-run, since in the long-run, the BoG should achieve its desired NFA holdings, and therefore changes in its NFA are zero. In the short-run, however, for a given level of aid inflow, decreases in the actual NFABOG should, ceteris paribus, lead to real appreciation of the cedi. This is because it makes real resources available and therefore increased aggregate spending. Net Foreign Assets of Commercial Banks: The influence of Commercial Banks in the foreign exchange market can have a stabilising effect on the real exchange rate. By buying foreign currency when there is excess supply, and selling off when there is excess demand, they act as stabilising speculators. In other words, temporary increases in the demand (supply) of foreign exchange due to, say, increase in imports (exports) that tend to depreciate (appreciate) the cedi, will cause the commercial banks to decrease (increase) their NFA holding. This will slow down the rate of depreciation (appreciation) of the cedi. For a given flow demand for foreign exchange, however, an increase in their NFA holding, ceteris paribus, leads to real depreciation of the cedi (see Sanusi, 2009). This implies that we should observe a negative relationship between real depreciation and NFA of commercial banks.

#### **Empirical Framework: Cointegration Analysis**

Johansen's (1995) maximum likelihood approach is used to estimate the model (Equation 1). The well known desirable property of this approach relative to others is that apart from testing for cointegration, it also reveals the number of cointegrating vectors. Because estimation is based on full information maximum likelihood (FIML), it also addresses the potential problem of simultaneity[4]. This approach involves the following. Define xt as an  $(n \times 1)$  vector of the real exchange rate (e) and its fundamentals (F) specified in equation 7. 11, which are all I(1). i. e., . The vector autoregressive form of xt can be written as: 6where  $\eta$  is an ( $n \times 1$ ) vector of deterministic variables,  $\varepsilon t$  is an (n×1) vector of white noise disturbance with zero mean and covariance matrix  $\Sigma$ . Assuming the data are I(1), we may write the VAR (equation 7.16) in vector error-correction terms: 6awhere:  $\Delta$  is the first difference operator;  $\Phi$  is an (n×n) coefficient matrix;  $\Pi$  is an (n×n) matrix with rank, r (which is the number of linearly independent stationary combination of the variables), determines the existence of cointegration. If the rank of  $\Pi$  is non-zero but less than full (i. e., 0 < r < n), then there exist two  $(n \times r)$  matrices a and b such that  $\Pi = ab'$ . The columns of b span the " cointegrating space" of stationary combinations of the xit. It therefore shows the combination of long-run relationships amongst the variables. The rows of a give the weights with which these combinations enter the individual reduced-form equations, denoting the speed of adjustment from disequilibrium. So that equation 7. 16a now becomes6bTo test for the existence of cointegration among the real exchange rate and its fundamentals, the Trace test is proposed by Johansen (1995). The hypothesis that there are at most r cointegrating vectors is stated in the form of: https://assignbuster.com/real-exchange-rate-fundamentals-economics-essay/

7where: are the N-r smallest squared canonical correlations between xt-k and  $\Delta$ xt series. The Trace statistic has a non-standard distribution and the critical values are provided by Johansen (1995) and others.

### **Data and Sources**

All the data, except the real effective exchange rate index, were obtained from the IMF International Financial Statistics online database, World Bank Development indicators, and World Bank Africa Database CD ROM 2008. Specifically, the variables are constructed as follows: NEER and REER: We computed the trade-weighted CPI-based Nominal Effective Exchange Rate and Real Effective Exchange Rate with weights based on Ghana's total trade (Exports + Import) with its 22 trading partners[5]. Aid Inflows (AIDY) is the log of (Net) Official development assistance and official aid (as % GDP) obtained from the WDI. Terms of Trade (TOT) is obtained from the World Bank's World Development Indicators (WDI, code: NE. TRM. TRAD. XN )Openness: The three measures of openness include; Open1 which is the log of imports plus exports as percent of GDP all in constant prices; Open2 is the log of current imports as percent of current GDP; and Open3 which is the log of imports in constant prices as percent of domestic absorption (in constant prices). All data obtained from the WDI. Government Consumption (GCY) is the log of the general government final consumption expenditure as a percent of GDP, obtained from WDI (NE. CON. GOVT. ZS)Net Foreign Assets: Net foreign assets of Bank of Ghana and those of Commercial Banks are obtained from the IFS. Both expressed as ratio to imports: NFABOG = In[(NFA of BoG/Import)+1)], and NFAB = In[(NFA of Banks/Import)+1)]Total Capital Inflows (Rbal): We measure total capital inflows as the difference

between imports and exports plus increases in the NFA of the banking sector as a ratio of GDP. It measures the impact of total capital inflows (AID, remittance inflows and FDI). It is calculated as the log of [(M-X) + $\Delta$ NFABS+1]/GDP, where X is exports, M is imports; NFABS is the net foreign assets of the banking system.

## **ESTIMATION RESULTS**

#### **Unit Root Tests**

To test for cointegration between the real exchange rate and its fundamentals, we started with testing each variable for a unit root. In addition to the standard tests (the ADF and Phillips-Perron), we also conducted the Zivot-Andrews test which takes into account possibility of a structural break[6]. The results, reported in Table Unit Root Test Results: Zivot-Andrews below, suggest that all the variables are stationary in first difference but not in levels, implying that they are integrated of order 1, i. e., they are all I(1), as required by the cointegration analysis. Table Unit Root Test Results: Zivot-AndrewsLevelCritical Value: 1%: -5. 575%: -5. 08First differenceCritical Value: 1%: -5. 43 5%: -4. 80CommentREER-3. 616 (1983)-9. 093 (1982)\*\*I(1)AIDY-4. 109 (1967)-9. 749 (1968)\*\*I(1)GCY-4. 610 (1981)-5. 083 (1983)\*\*1(I)OPEN1-4. 311 (1980)-8. 195 (1982)\*\*I(1)TOT-4. 609 (1989)-6. 865 (1981)\*\*I(1)NEER‡-2. 372 (1973)-8. 080 (1982)\*\*I(1)RBAL-5. 130 (1989)-7. 334 (1993)\*\*I(1)NFABOG-2. 860 (1985)-11. 222 (1984)\*\*I(1)NFAB-4. 431 (1982)-9. 176 (1982)\*\*I(1)Notes: For test at levels, we included both trend and intercept; but at first difference, only intercept is included. ‡ Only break in trend is assumed in level, but intercept in first difference.

#### **Tests of Cointegration Rank**

Having confirmed that the real effective exchange rate (REER) and all the variables to be included in the set of potential economic fundamentals (F) are integrated processes of order one, I(1), Johansen's cointegration test is then conducted. We divided the fundamentals into two sets: In the first set, FRBAL, total capital inflows (Rbal) are included while in the second set, FAID, aid inflows are included as a measure of capital inflows. Specifically, these sets of fundamentals are: FAID = [AIDY GCY, TOT, OPEN], FRBAL = [RBALY, GCY, TOT, OPEN]. The first set, FAID, allows us to measure the long-run effect of aid inflows in Ghana, while the second set, FRBAL, allows us to measure the effect of total capital inflows. We estimated the vector errorcorrection model given by equation 6b above, but included a shift dummy as exogenous variable to capture the permanent impact of the 1983 economic reforms on the real exchange rate[7]. So that:; and We determined the optimal lag length (p) using three traditional model selection information criteria (AIC, SIC and HQIC) from the estimates of an unrestricted VAR in levels that included intercept and the shift dummy variable. For both specifications, we found the optimal lag length that makes the VAR residuals free from autocorrelations to be one (p = 1). The unrestricted VARs were then tested for stability under the chosen lag. All the roots of the characteristic polynomials lie within the unit circle, thus meeting the stability condition (see Error: Reference source not found in the Appendix). The cointegration tests results are reported in Tables 2 and 3 below. In Model 1, the Trace test suggests that there is only one cointegrating relation between REER and FAID at 5 percent level of significance[8]. By normalising the cointegrating vector (CV) on the real exchange rate, the CV is identified as the long-run https://assignbuster.com/real-exchange-rate-fundamentals-economics-essay/ relationship between REER and its fundamentals. This is because all the elements in the CV have the theoretically expected sign, and plausible magnitudes. In addition, it is only the adjustment coefficient in the  $\Delta$ REER equation that is negatively signed and is statistically significant (= -0. 76). For Model 2, the Trace test also suggests one cointegrating relation. We then normalise the vector on the REER to identify the vector. As in model 1, the signs of each element are as theoretically expected and the adjustment coefficient corresponding to  $\Delta$ REER equation is negative and statistically significant[9]. Therefore, the cointegrating relation can be identified as the long-run relationship between the real exchange rate and its fundamentals. Table Cointegration Test Results (Model 1)

## Trace Rank Test (Model 2, FAID)

Hypothesisr =  $0r \le 1r \le 2r \le 3r \le 4$ Trace Statistics98. 2654. 6633. 0814. 012. 5995% Quantiles

### 78.767

55. 50935. 55319. 2295. 938

# **Estimate of the (Identified) Long-Run Equation**

REERAIDTOTGCYOPEN1D83CCVt-stat

- 1.00
- -0.18
- (3.21)
- -0.57
- (-3.77)

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## -0.83

(-5.23)

## 0.56

(6.65)

## 0.94

(4.90)

## -2.26

Adj. α

## -0.76\*

0. 430. 130. 120. 21

# Test of Significance and Exclusion (of a given variable under r = 1)

REERAIDTOTGCYOPEN1LR  $\chi^2(1)$ (P-Value)8.05

## (0. 00)

3. 88

## (0.04)

10.14

## (0.01)

9. 43

# (0. 01)

5.18

# (0. 02)

# **Misspecification Tests**

EquationREERAIDTOTGCYOPEN1Joint TestNormality  $\chi^2$  (1)0. 875(0. 65)4.

58(0. 10)1. 69(0. 43)4. 72(0. 09)2. 72(0. 26)14. 59(0. 15)Hetero201. 93(0.

35)lags1234SC (LM, χ2 (25)28. 75(0. 27)33. 63(0. 11)26. 21(0. 39)28. 89(0. 26)

# Likelihood Ratio Statistics for Testing Weak Exogeneity of Each Variable with respect to β

REERAIDTOTGCYOPEN1Weak Exogeneity  $\chi^2(1)$ P-Value13. 51

# (0. 00)

1. 86(0. 17)1. 21(0. 26)0. 92(0. 34)3. 17(0. 07)All Fundamentals Jointly  $(\chi^2(4))$ 13. 2(0. 01)Note: The test of exclusion is used to further ensure that the CV is a long-run relationship between REER and its fundamentals and not among the fundamentals only. Table . Cointegration Test (Model 2)

# Trace Rank Test (Model 2, FRBAL)

Hypothesisr =  $0r \le 1r \le 2r \le 3r \le 4$ Trace Statistics86. 1844. 3523. 7710. 723. 0895% Quantiles78. 76755. 50935. 55319. 2295. 938

# **Estimate of the (Identified) Long-Run Equation**

REERRBALTOTGCYOPEND83CCVt-stat

1.00

-0.93

(-2.87)

## -0.96

(-3.96)

## -0.70

(5.89)

## 0.63

(-8.97)

## 0.73

(4. 58)

## 3.17

Adj. α-0. 81\*-0. 010. 280. 240. 28

# Test of Significance and Exclusion (of a given variable under r = 1)

REERRBALTOTGCYOPENLR  $\chi^2(1)$ (P-Value)17.79

## (0. 00)

5.51

## (0. 02)

5.56

## (0.01)

16.02

## (0. 00)

18. 52

# (0. 00)

## **Misspecification Tests**

EquationREERRBALTOTGCYOPENJoin testNormality  $\chi^2$  (2)1. 17(0. 56)36.

25(0. 00)0. 74(0. 69)4. 53(0. 10)3. 17(0. 20)45. 86(0. 00)Hetero216. 39(0. 14)lags1234SC. LM, χ2 (25)29. 69(0. 24)24. 52(0. 50)8. 38(0. 99)25. 95(0. 41)

# Likelihood Ratio Statistics for Testing Weak Exogeneity of Each Variable with respect to β

REERRBALTOTGCYOPENWeak Exogeneity  $\chi^2(1)$ P-Value1. 039

# (0. 00)

0. 06(0. 81)1. 65(0. 19)2. 58(0. 11)2. 72(0. 10)All Fundamentals Jointly ( $\chi$ 2(4))9. 93(0. 04)Notes: Figures in brackets are the relevant p-values, unless otherwise stated. The diagnostic tests conducted reveal that the residuals in Model 1 are free of autocorrelation, normality or heteroskedasticity at 5 percent significance level. However, in Model 2, the residuals fail only the normality test, due to excess kurtosis[10].

# The Long-Run Parameters

Having confirmed the existence of one long-run relationship between the real exchange rate and its fundamentals in both specifications, this section discusses the estimates of the long-run parameters. First, however, we briefly address the issue of weak exogeneity, which is central in choosing the appropriate estimation method, i. e., single equation or system method. The idea that the fundamentals, F, have to be weakly exogenous for the parameters of interest (the long-run parameters and adjustment coefficients)

means that changes in fundamentals ( $\Delta F$ ) do not respond to past disequilibrium. If this is the case, then the long-run parameters can be directly recovered from the distribution of the real exchange rate conditional on its fundamentals, since there are no cross-equation restrictions linking the parameters of the real exchange rate model with those of the marginal models for the fundamentals[11]. Within the IML framework, Johansen (1992) shows that a weak exogeneity test for the fundamentals is equivalent to Likelihood Ratio test of restrictions on the adjustment coefficients of the fundamentals (aFi) for the identified cointegrating vector bi. That is, with one CV identified as bREER, the restriction to be tested is aF = 0. Equivalently, the rows of a corresponding to individual  $\Delta F$  equations are zero. In the case of Model 1, the restriction to be tested is aAID = aGCY = aTOT = aOPEN = 0while in Model 2 the restriction would be aRBAL = aGCY = aTOT = aOPEN(see also Ericsson et al., 1998 and Ericsson, 1994). The last panel of Tables 2 to 3 above reports the test results for weak exogeneity of each individual variable and the fundamentals jointly conducted for each model. In both models, while the restrictions that the fundamentals are individually exogenous cannot be rejected at 5 percent level of significance, the joint restriction tests can be rejected. This suggests that the fundamentals are individually exogenous at 5 percent level of significance, but not jointly. The implication of these results is that, in both specifications, the long-run parameters may not be efficiently estimated with single-equation techniques; the models have to be estimated as a full system for valid inference from the long-run parameters. It should be noted, however, that the only difficulty this failure of weak exogeneity of the fundamentals poses within the single equation approach lies with the estimation of b. Johansen https://assignbuster.com/real-exchange-rate-fundamentals-economics-essay/

(1992) notes that the single equation estimator of b will still be consistent, but the asymptotic distribution of the estimator does not permit the use of the usual  $\chi^2$  distribution. All inferences on b should therefore be done in a full or partial system framework and once all the relevant hypothesis have been tested, the single equation approach can be used to estimate and make the usual inferences on the remaining parameters keeping b fixed. We therefore reproduce the maximum likelihood estimates of the long-run parameters reported in Tables 2 and 3 here (the data are in logarithms, tstatistics in parentheses): 89As noted above, the coefficients on all the fundamentals have the theoretically expected signs and plausible magnitudes, and are statistically significant. However, there is variation in the magnitude of the coefficients (especially of TOT) between the two specifications[12]. The coefficient on aid inflows appears with the expected positive sign, suggesting that in the long-run, aid inflows do cause real appreciation in Ghana. However, the magnitude of 0. 18 is relatively small, implying that a 10 percent permanent increase in aid inflows leads to about 2 percent real appreciation. This finding lends support to those of Younger (1992) and Opoku-Afari et al. (2004). However, this finding is contrary to some other previous empirical studies which suggest that aid inflows lead to real depreciation. Such studies include Sacky (2001) for Ghana and Nyoni (1998) for Tanzania[13]. In Model 2, the impact of total capital inflows is measured by the coefficient on RBAL variable. The coefficient is positively signed as expected, suggesting that permanent increase in capital inflows leads to real appreciation of the cedi. This suggests that increase in these flows raise domestic absorption and shifts the composition of potential output towards non-tradables. The elasticity of 0. 93 suggests a 10 percent https://assignbuster.com/real-exchange-rate-fundamentals-economics-essay/

increase in capital inflows leads to 9. 3 percent real appreciation of the cedi. The magnitude found here is within the rage found for Ghana by Opoku-Afari et al. (2004) with similar measures (elasticity range of 0.5 to 2.0), and those found for other African countries (for example, Baffes et al., 1997 found 1. 5 for Burkina Faso and 0. 26 for Cote d' Ivoire). The effect of terms of trade on the real exchange rate is positive, suggesting that a permanent commodity price shock that leads to long-run improvement in the terms of trade tend to appreciate the real exchange rate. In terms of magnitude, the effect of 10 percent terms of trade improvement is a real appreciation of about 5. 7 percent in Model 1, and about 9. 6 percent in Model 2. This suggests that the spending effect of improvements in TOT dominates the substitution effect in Ghana raising non-traded goods demand. The dominance of the income effect, leading to a positive relationship between real appreciation and TOT, is consistent with the bulk of the empirical literature. In addition, the magnitude found here is within the rage found elsewhere. For example, for Ghana Sacky (2001) found an elasticity of 0. 60, but Opoku-Afari et al. (2004) found it to be 1. 7, 0. 84 and 1. 22 depending on the set of fundamentals used. The effect of trade policy stance or openness to trade is also as expected; the negative sign suggests that as trade and exchange restrictions were eased, the real exchange rate depreciated. The effect of a 10 percent reduction in trade restriction is about 5. 6 percent (or 6. 3 percent in Model 2) real depreciation. These magnitudes are close to those found in other empirical studies on the SSA countries (for example, Nyoni, 1998 found the effect to be 8.2 for Tanzania while Opoku-Afari et al., 2004 found it to be between 8. 4 and 12. 2 percent for Ghana depending on which measure of capital inflows is used). The coefficient on https://assignbuster.com/real-exchange-rate-fundamentals-economics-essay/ government consumption spending also conforms to the theoretical expectation; the positive sign implies that increase in government spending leads to real appreciation of the cedi. This implies that a significant proportion of government consumption expenditure is on non-tradables. The elasticity of 0. 83 (and 0. 70) suggests an 8. 3 (7. 0) percent real appreciation of the cedi for every 10 percent increase in government consumption spending. The effect of the 1983 reforms, captured by the coefficient on the shift dummy (D83) in the VECM, is negative as expected, suggesting that the reforms have had a depreciating effect on the real exchange rate.

### **Short-Run Dynamics**

In estimating the short-run real exchange rate model, one period lag of the residuals from the long-run equations is used as the error-correction term (ECi, t-1). This strategy, as noted earlier, allows valid inference and efficient estimation from single-equation estimates even with the failure of weak exogeneity (see Johansen, 1992; Ericsson et. al., 1998; Durevall, 1998; and Metin, 1998). The single equation modelling starts with a general dynamic model involving the first difference of all the fundamentals, their first lags and ΔREERt-1 and one period lag of the residuals from the cointegrating equation. The general ECM corresponding to the two long-run models can be written as[14]: 10and11where: wt represents the intercept and other special events or impulse dummy variables. The estimates of the general unrestricted ECM models corresponding to the two alternative specifications and the diagnostic tests are reported in Table A. 2 of the Appendix. The residuals from both estimated models have passed the diagnostic tests for

autocorrelation, non-normality, autoregressive-conditional heteroskedasticity (ARCH), and model specification (RESET). In both models an additional dummy variable, D78, is included to capture the effect of the 1978 nominal devaluation, which hitherto produced an outlier in the residuals. The general models were then simplified using the general-to-specific test procedure to obtain the parsimonious and final short-run models. This involves eliminating the insignificant coefficients by using various coefficient restriction tests. The parsimonious short-run models of real exchange rate obtained for the alternative specifications are as follows:

### Model 1

 $\Delta$ REER = 0. 15 - 0. 25ECAID, t-1 + 0. 50 $\Delta$ REERt-1 - 2. 12 $\Delta$ NFABOG, t[0. 01] [0. 01] [0. 00] [0. 02] + 0. 34 $\Delta$ GCY, t - 0. 30 $\Delta$ GCY, t-1 - 0. 29 $\Delta$ OPENt + 0. 63 $\Delta$ NEERt -0. 49 $\Delta$ NEER t-1[0. 00] [0. 01][0. 02][0. 00][0. 00] + 0. 28D78 - 0. 25D83[0. 00] [0. 02]Adj. R2 = 0. 91, SE = 0. 10, DW = 2. 01, SC(LM, 1) = 0. 12(0. 73), ARCH: F = 0. 62(0. 44), Normality:(2) = 2. 11 (0. 35), White F: 1. 11(0. 41), and RESET: F(1, 21) = 0. 41 (0. 52). T = 46 (1960-2006)

### Model 2

 $\Delta REER = 0. 14 - 0. 47ECt-1 + 0. 55\Delta REERt-1+0. 48\Delta RBALt - 1.$   $91\Delta NFABOG[0. 01] [0. 00] [0. 00] [0. 03][0. 02]+0. 31\Delta TOTt + 0. 43\Delta GCY, t - 0. 31\Delta GCY, t-1 - 0. 39\Delta OPENt + 0. 57\Delta NEERt[0. 01] [0. 00] [0. 00] [0. 00][0. 00][0. 00][0. 00][0. 00][0. 00][0. 00][0. 00][0. 00]] = 0. 47\Delta NEER t-1 + 0. 27D78 - 0. 25D83[0. 00][0. 00][0. 00]Adj. R2 = 0.$  93, SE = 0. 10, DW = 1. 99, SC(LM, 1) = 3. 06(0. 07), ARCH: F = 2. 85(0. 10), Normality:(2) = 1. 48 (0. 47), White F: 1. 60(0. 14) and RESET: F(1, 31) = 0. 03 (0. 86). T = 46 (1960-2006)NOTE: Figures in square brackets are p-values. The diagnostic checks for residual autocorrelation (SC-LM I) confirm https://assignbuster.com/real-exchange-rate-fundamentals-economics-essay/

the choice of one lag, residual heteroskedasticity of the ARCH form (ARCH 1 F test) suggested by Engle (1982). RESET-F is the regression misspecification test. It tests the null of correct specification of the original model against the alternative that powers of the dependent variable are present. The parsimonious short-run models have passed a battery of diagnostic tests including autocorrelation, normality, ARCH, heteroskedasticity, and Ramsey RESET tests. Stability tests such as the CUSUM test, CUSUM of squares test, one- and N-step forecast tests, and recursive residuals and recursive coefficient estimates reveal no evidence of instability (reported in Figures A. 2 and A. 3 in Appendix). The actual and fitted values of the short-run models are shown in Figure A. 1. The coefficients on the error-correction term have the expected negative sign and are statistically significant in both models. Because greater parsimony is achieved in Model 1, and we are more interested in the effects of aid inflows rather than total capital inflows, we concentrate on Model 1 henceforth. The negative sign of the lagged error term, ECAID, t-1, implies that whenever a gap between the real exchange rate and its equilibrium level rises, the actual real exchange rate will tend to converge to its equilibrium. The magnitude of the error-correction term, 0. 25, measures the speed with which the REER returns to its long-run equilibrium level. This suggests that 50 percent of the disequilibrium will be corrected in about 2. 4 years provided that there are no further shocks[15]. Although small, this magnitude is in the range of those found in other studies. The negative sign and significance of the ECi, t-1 term also confirms the existence of cointegration between the real exchange rate and its fundamentals. The dynamic model depicts the net reduced-form behaviour among these variables as they shift from one equilibrium position to another. https://assignbuster.com/real-exchange-rate-fundamentals-economics-essay/ A possible mechanism could be as follows: An exogenous increase in the NFA of the Bank of Ghana due to, say, a revised floor on the NIR by the IMF, which reduces the amount of real resources available for spending, leads to real exchange rate depreciation. The new equilibrium associated with the increase in NFABOG is at lower REER, given GC, OPEN and NEER. On the whole, the results show that in the long-run (equation 8), higher level of AID, improvement in terms of trade, higher level of government consumption, and higher trade restrictions are associated with higher (appreciated) real exchange rate. Real misalignments or short-run deviations, according to our model, are driven by changes in the NFA of the bank of Ghana, government consumption spending, openness to trade and nominal depreciation. The D83 dummy suggests that the rate of real exchange rate depreciation is on average greater after rather than before the reforms. The D78 dummy is an impulse dummy (1 in 1978 and 0 otherwise) included to capture outlier in the residuals during this period[16]. The short-run dynamics reveal the following results: first, changes in aid inflows do not enter the parsimonious short-run model, suggesting that increases in foreign aid inflows have no short-run effects on the real exchange rate in Ghana. This is plausible given the empirical findings in IMF (2005a, 2005b) that aid surges in were not fully absorbed and mostly saved in the form of reserves. Secondly, NFA accumulation by the BoG tends to have a depreciating effect on the real exchange rate in the short-run. Given this result, we can interpret the recent increase in reserves accumulation amidst aid surges by the BoG as an attempt to prevent real exchange rate appreciation, or to prevent appreciation, as noted by IMF (2007a). This behaviour by the BoG is consistent with the stated objective of IMF monetary programme of https://assignbuster.com/real-exchange-rate-fundamentals-economics-essay/

maintaining Ghana's external competitiveness (or the incentive to produce for exports). Thirdly, the nominal effective exchange rate is included to capture the direct short-run effects of devaluations/depreciations. Long-run homogeneity implies that nominal devaluation has only a transitional role in macroeconomic adjustment. Shocks that depreciate the equilibrium real exchange rate will generate contractionary adjustment. Nominal devaluation under a fixed regime (or inducing depreciation via intervention under a managed float) will play an important role in efficient macroeconomic adjustment (Baffes et al., 1997). The estimated parameters of both contemporaneous and lagged nominal appreciation support this view: i. e., a positive contemporaneous and negative lagged effect. In the current period, the elasticity of 0. 63 implies that should the real exchange rate be overvalued, a 10 percent nominal devaluation would lead to an immediate 6. 3 percent real depreciation. But the negative coefficient of the one period lag suggests that after a first year of the devaluation, the real exchange rate would appreciate back by 4. 9 percent, as prices respond to the initial nominal depreciation with a delay. The total effect of a 10 percent nominal devaluation over two years is therefore only 1. 4 percent, thus implying an exchange rate pass-through of 86 percent. Given the empirical evidence that BoG's policy on NFA holdings has a significant impact on the real exchange rate, and the dramatic rise in the BoG's NFA in recent years (from about US\$70 million in 2001 to over US\$2 billion in 2006), the next section examines the issue of misalignment. That is, what are the effects of the recent accumulation of foreign reserves by the Bank of Ghana on the deviations of the real exchange rate from its long-run equilibrium?