The Effects of Real Exchange Rate on Trade Balance in Cote d'Ivoire: Evidence from the Cointegration Analysis and Error-Correction Models.

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Abstract

This paper investigates the effect of real exchange rate on the balance of trade of Cote d'Ivoire using multivariate cointegration tests and vector error correction models with time series data covering the periods of 1975-2007. Our investigation results confirm the existence of long-run relationships among Trade Balance(TB), Real Exchange Rate(RER), and foreign and domestic incomes for Cote d'Ivoire. Estimated results also demonstrate that the (RER) has a significant positive influence on Cote d'Ivoire's trade balance in both short and long-run under fixed real exchange rate management policies for the considering period. The Granger Causality test shows that the (RER) does Granger causes the trade balance then, based on the estimations, the Marshall-Lerner condition in Cote d'Ivoire's data is explored by utilizing the Impulse Response Function (IFR) which traces the effect of (RER) on the trade balance viewing the J-curve pattern.

Key words: Real exchange rate, Trade balance, Cointegration test, VAR model, Granger Causality, IFR.

1. Introduction

The effectiveness of different exchange rate system in promoting competitiveness in international trade and their impact on macroeconomic stability have been discussed by (Wickham, 1985), (Frankel, 1996)and others researchers after the second world war. Most recently, the debate has based on the appropriate choice of exchange rate regime for transition economies. The exchange rate is one of the most important policy variables, which determines the trade flows, capital flows and foreign direct investment, inflation, international reserve and remittance of an economy (Nusrate, 2008). Many economies, especially African countries faced crisis in 1990s due to miss application and bad choice of exchange rate regime. However, there is no consensus in the theoretical or empirical literature about any unique effect of the exchange rate volatility on macroeconomic indicators. Especially in Africa, one of the most important problems identified in developing economies in general, is the government budget deficit and the balance of payments. These countries have benefited aid in the form of grants and loans from the Breton Wood Institutions (IMF, World Bank) and other financial institutions to face these deficits. More often than not this assistance is given on condition that the borrowing country implements specified reforms in policy. Since the 1970s, these policy reforms have changed considerably, gradually, leading the way toward a more liberal market mechanism (Bhattarai & Armah, 2005). Furthermore the economic performance has led a number of countries in Sub-Saharan Africa to undertake key policy reforms to adjust the structure of their economies over the past decade. A major goal of these reforms has been to reduce the bias against exports resulting from export taxation, trade protection for import-competing activities, and an overvalued domestic currency. Also important have been the freeing up of markets and the reduced relative importance of the public sector in the economy. The World Bank and IMF have had a major influence in defining the policy reforms undertaken by these countries. In addition to macroeconomic stabilization

measures, these reforms have comprised some combination of: i) devaluation, ii) movement toward a more flexible exchange rate, iii) reduction or elimination of export taxes, iv) easing or elimination of import controls, v) Reduction in the magnitude and variability of import tariffs, privatization, vi) elimination of price controls and restrictions on the involvement of the private sector in marketing activities, and vii) Reduction in public-sector employment. Whether these reforms have been successful in expanding exports and increasing economic growth is less clear, due to the clouding effect of other variables. Many of the countries undertaking major reform programs have also experienced a severe deterioration in their terms of trade. On the other hand, they have benefited from debt relief and increased flows of foreign aid, which has helped to sustain investment at a time when public budgets have been severely reduced (World Bank and UNDP 1989, pp. 27-29). As a result, developing countries' governments have been put under enormous pressure to abandon inward oriented, export pessimism, import substitution industrialization (ISI) development strategies and to stake the future of their people on increasingly 'unprotected' participation in the international market.

In addition, particularly in Cote d'Ivoire affiliate to francophone economic grouping has followed "fixed exchange regime" after independence in 1960 and was successful in using the fixed exchange rate regime as a tool for macroeconomic stability. However, since the 1980s trade and budget deficits have become larger and exponential, the exchange rate originally peg to French currency met twice devaluation respectively in 1882 and October 1994. All the exchange rate policies Cote d'Ivoire has taken, mainly, to accelerate exports, reduce extra pressure of imports and thereby improve the balance of trade. The following studies confirm the above argument. According (Islam, 2003), the monetary authority determines the exchange rate policy aiming to achieve two main objectives. First, the 'domestic target', which includes restraining inflation rate, credit growth in the public and private sector, and the growth of liquidity and broad money. Secondly, the 'external target', which includes promotion in international reserves level, reduce the current account gap, control trends of exchange rate changes in the local inter-bank foreign exchange market, and adjust the trends in the exchange rates of neighboring trade partners. Several exchange rate policies, including policies under the 1980s Structural Adjustment have been pursued for stabilization however; there is still debate whether devaluation really improves a country's trade balance and continue to dominate public discourse at world undeveloped economies. This paper examines whether fluctuation in the real exchange rate and the national income and domestic income affect the trade balance both in short and long-run. The rest of the study is structured as follows: in section 2, we briefly explore the historical overview of exchange rate regime in Cote d'Ivoire particularly in West African French speaking countries. Section 3 is devoted to an overview of empirical literature. It clarifies and analyses the theoretical justification of our study. Section 4 outlines the model specification and estimation methods then we also describe the source of our selected data. Section 5 highlights the econometric analysis and interpretation of the short and long-run impacts of exchange rates on imports and exports in Cote d'Ivoire. It is followed by the summary, policy discussions and conclusions, respectively in section 6.

2. Historical overview

2.1. The colonial origins of exchange rate regime.

Created in 1945, the CFA Franc (FCFA is Cote d'Ivoire's currency name) takes it origin in the consolidation of the French colonial economies in the 1940s and 1950s. In 1948 the parity was fixed at 0.5FCFA to 1FF (France currency name before Euro) and its nominal parity was changed at the French currency reform of 1968 to 50FCFA to 1FF. From 1948 its parity to the French Franc therefore remained unchanged up to 1994s devaluation (African Research group 2001). Initially, the currency was issued by the French central Bank but this responsibility was later delegated to regional issuing banks, established in 1955 and consolidated after independence in 1962. After the 1974 reforms, both banks which were initially based in Paris but were moved to Africa. It was an arrangement between France and 15 African countries, and includes two monetary unions (plus the Comoro Islands, which has its own "Franc Comorien") managed by two central banks, the Central Bank of West Africa States (BCEAO) for the West Africa Economic and Monetary Union (WAEMU) which regroups 8 countries in West Africa, and the Bank of Central Africa States (BEAC) for the Central Africa and Monetary Community (CAEMC) which regroups 6 countries in Central Africa. Because of its original mechanisms the peg to the French Franc (FF) through a fixed exchange rate backed to the 1972-74 treaties signed by the French Treasury and the associated monetary discipline , the Franc Zone has been partially protected from recurrent monetary crises for example the hyperinflation that affected other African countries remain the unique post colonial currency relationship.

The parity of the CFA francs to the French franc is fixed, subject to changes agreed unanimously by the members of either zone, in consultation with France. The convertibility of the CFA Franc into French Francs is guaranteed by the French government. Until 1993 there was a free mobility of capital transfers between France and the zone, although administrative procedures hindered this in practice. As a counterpart to this guarantee, the States of the zone, through the articles of the central banks and through specific treaties, agree to hold 65% of their foreign exchange assets in special "operations accounts" at the French Treasury, and to keep credit and liabilities within agreed limits. Deficits in the operations account are covered by the French Treasury, effectively giving the Franc Zone States an overdraft facility. France has kept a close scrutiny of this by participating in the executive boards of the issuing banks. The Franc Zone has been partially protected from recurrent monetary crises, for example the hyperinflation that affected other African countries. This arrangement functioned well during the years of prosperity in France after the Second World War and in the CFA zone during the period of growth, which lasted from the years of independence around 1960 until the second oil shock in 1979 and the counter-shock in 1986, and the subsequent decline of the international prices of primary commodities. From the French side this arrangement has only a small cost, although this has risen slightly since the operations account went into deficit in the mid 1980s. The monetary mass of the African Franc zone was equal to only 2.8% of the French Franc before devaluation in 1994, 1.4% afterwards. The French position vis a vis the Franc Zone is best seen as a macro level cost for a micro level benefit. The small cost of maintaining the zone is borne by the French State while the currency stability it guarantees with the French Franc has favored French companies in their dealing in the zone. On the African side the relationship has entailed advantages and disadvantages, depending on the economic environment. The advantages were: i) guaranteed currency stability with France; ii) encouraging investment and trade; iii) France is the major trading partner with 21% of the zone's exports and 35% of its imports; iv) financial and budgetary discipline is assured by binding treaties. On other hand the disadvantages can be cited as follow: i) an inability to change currency parities in response to changes in prices of African exports. This is called the "asymmetric shock" problem, related to the different economic profiles of France and the African Franc Zone. ii) the necessity of following French interest rates to prevent capital flight, no matter what conditions prevail in the Franc Zone.

Moreover, primary commodities remained the main source of foreign exchange because the economy diversification did not occur then, at the end of the 1970s the Zone countries were affected by a severe drop in the terms of trade. Therefore, the Franc Zone faced important budgetary and Balance of payments deficits between 1980 to 1986.As a result, the Franc Zone countries were oblige to solicit the Bretton Woods institutions to finance the stabilization programs. Soon after the implementation of the structural adjustment programs, the visible and direct consequences occurred were: i) the loss of sovereignty ii) flexibility over monetary , iii) fiscal policies, iv) and exposure to economic shocks stemming from the variations in the French Franc exchange rate vis-à-vis the US dollar. The CFA Franc remained however pegged to the French Franc, generating an increasing gap between the CFA Franc exchange rate and the country’s economic fundamentals as well as CFA overvaluation. The economic degradation that started in the 1980s was also due to poor economic policies and budgetary mismanagement that interestingly has not been impeded by the written rules of the Franc Zone and their ceilings on authorized budget deficits. Likewise, the monetary union did not discipline the expansion of foreign borrowing, nor prevent the debt explosion of some WAMU (West African Monetary Union) countries (Anne-Sophie Claeys & Alice Sindzingre, 2003).

2.2. The 1980s shock and the zone exchange rate regime instability.

The economies of the Franc Zone performed very well compare to the rest of Sub-Saharan Africa in terms of both growth and controlling inflation up until the 1980s. However in the 1980s the Franc zone countries had faced severe external shocks. The French Franc appreciated vis a vis the dollar, which is the denomination currency for international commodity purchasing and commodity prices fell sharply. In the same order, this led to Franc zone products being uncompetitive relative both to emerging Asian producers and English speaking countries in West Africa. As a result important loan has been contracted by Franc Zone countries during this period consequently led Structural Adjustment program since the beginning of the 1980s. Furthermore, the Bretton Woods institutions were pushing for devaluation from the late 1980s. France was bailing the Franc Zone countries out through the Franc zone mechanisms as well as through program aid. In January 1994, due most directly to French budgetary constraints it was therefore decided to devalue the CFA Franc by 50% (1FF now equals 100FCFA). This important economic and political decision marked the end of French domination on the region. The 1994s devaluation was intended to solve budgetary problems by stimulating export value and optimize the management of donor’s receipts. The risk of high inflation rate due to increased import costs and wage demands was contained after initial worries of the concerning states authorities. The objective of replacing imports with domestic commodities by price adjustment was

unsatisfactory due to lack of elasticity of supply in the African economies, in other words imports levels remain high because the zone productivity level was very low. In fact we understand and agree that the devaluation was a necessary but insufficient solution tool to solve the current economic problems of the Zone. For example, a small increase in commodity prices in 1995 - 1997 led a boost to the region's economy and rather affected the devaluation's outcome. The devaluation has been accelerated by the advent of the Euro, in addition to the pressure of the Bretton Woods institutions which therefore conditioned the French aid to agreements with the Bretton Woods institutions and the extreme and costly budget degradation of certain countries, for France and especially Cote d'Ivoire (Anne-Sophie Claeys & Alice Sindzingre, 2003).

Moreover, the uniform rate of the devaluation did not take into account the differences between countries, because financial and economic indicators were not homogeneous and displayed different levels of appreciation of their real effective exchange rate (30% in the small countries and 60% in the larger ones). The Treaties creating the WAEMU and the CAEMC in association with the devaluation were thus a political signal for the governments of the Franc Zone. However, the devaluation only modified the parity between the CFA Franc and the French Franc. The general institutional framework between the French Treasury and the Franc Zone countries remained broadly unchanged, with the French Treasury still guaranteeing the parity, international credibility of the CFA and the operations of the central banks. The WAEMU remains today a regional integration organization that was originally based on the sharing of a common currency by developing countries and guaranteed by a highly developed country, such as France. In the legal texts, the CFA countries seem to be responsible in their monetary policy. However, the mechanisms that underlie the Franc Zone maintain numerous channels for colonial dependence vis-à-vis the former colonial power. Because of the obvious asymmetry between France and the African countries in terms of economic weight as well as post-colonial dependence, the autonomy of the African governments' policies is tenuous: French economic policies determine the international value of the CFA Franc, while Franc Zone countries depend on the international prices of commodities for their balance of payment and hence the sustainability of their exchange rate, which is mostly expressed in US dollars. Likewise, their domestic economic policies are massively decided by the programmes of the Bretton Woods institutions (Anne-Sophie Claeys & Alice Sindzingre, 2003).

3. Literature Review

As we mentioned earlier in our introduction, the management of the Exchange Rate has been a critical issue for the economic policy and researchers, especially in developing countries. In the seminal paper of (Rose, 1991), he examined the empirical relation between real effective exchange rate and trade balance of major five OECD countries in the post-Bretton Woods era and found that the exchange rate as insignificant determinant of balance of trade. The research done by (Rose & Yellen, 1989) could not reject the hypothesis that the real exchange rate was statistically insignificant determinant of trade flows. They examined the bilateral trade flows between the United States and other OECD countries using quarterly data. Furthermore, the studies of (Singh, 2002) find that 'real exchange rate' and 'domestic income' explain a significant influence while 'foreign income' shows an insignificant impact on 'trade balance' this result for Indian data. Singh's study also demonstrates a very significant effect (+2.33) of real exchange rate and domestic income (-1.87) on Indian trade balance.

As far as we know, defining an exchange rate policy is one of the most important issues in the response of Trade Balance (TB) in term of trade or in general speaking, in Real Exchange Rate (RER). With more than forty years literature, the impacts of currency depreciation on a country's trade balance have been an important and debate in the development of international economic and trade especially the traditional studied in the Marshall-Lerner condition (ML) and the J-curve theory. According to the ML condition, currency devaluation improves the trade balance in the long run only if the sum of the absolute values of imports and exports demand price elasticities exceeds unit. However, due to the lag dynamics structure TB can worsen in the short-run because of the inelastic demand for imports and exports in the immediate aftermath of an exchange rate change. In this case TB is said to follow the J-curve pattern (David & Guadalupe, 2006). More recently, numerous papers have tested the ML condition and J-curve. (Bahmani-Oskooee & Niroomand, 1998) have tested the ML condition for thirty developed and developing countries covering the period of 1960-1992. In the same order, (Gomes & Paz, 2005) and (Tsen, 2006) find the existence of a long run relationship between trade balance, real exchange rate, foreign and domestic income for Brazil and for Malaysia during 1965-2002 respectively. All studies mentioned confirm the existence of the J-curve pattern except (Narayan, 2004) who does not confirm the ML condition in New Zealand.

In addition, economist such as (Tavlas, 2003) offers a review about issues of exchange rate particularly the types of exchange rate regimes, and also a critique of (Corden, 2002) and (Goldstein, 2002).However, (Mussa, 2002) and (Edwards, 2002) provide synoptic reviews and analyses of the real exchange rate especially they point out that exchange rate misalignment issues are very important in the exchange rate regime literature. In other words, the fundamentals fluctuations of macroeconomic policies lead to the disequilibrium of real exchange rate; if the nominal exchange rate remains fixed the result is misalignment between the real exchange rate and the new equilibrium rate. Moreover, various studies have explored and tried to identify effective exchange rate regimes in a world increasingly characterized by high capital flow mobility. For (Goldstein ,1992) policy advice from official circles proposed that countries could choose among a broad spectrum of exchange rate arrangements and that exchange rate commitments should be tailored to the characteristics and circumstances of individual countries.

However, the empirical studies on the effects of real exchange rates on the trade balance in Sub-Saharan forecast to Ghana case using the cointegration analyses of both single equation models and vector-error correction model revealed a stable long-run relationship between both exports and imports and the real exchange rate. At the same time, the research also demonstrates that short-run elasticities of exports and imports indicate contractionary effects of devaluation in terms of the Marshall-Lerner-Robinson conditions, then the study concludes that for improved balance of trade in Ghana, coordination between the exchange rate regime and demand management policies should be strengthened (Bhattarai & Armah, 2005). In fact, regarding the Cote d'Ivoire's case, the economic crisis experienced by the country partly reflects to the unstable exchange rate regime and more importantly reflects to imprudent policies adopted by governments in the past under the pressure of Breton Wood institutions, poor national budget management ,political instability ,which rendered it less competitive in the world. Thus, all the empirical studies and policy papers have directly or indirectly articulated, the export performance and imports contraction targets as the main objectives of the exchange rate policy of Cote d'Ivoire. However, hardly few studies investigated the effect of exchange rates on trade balance. Hence, this study aims at contributing in this area.

4. Model specification, estimation methods and data.

4.1. Model specification.

In this section, we examine the theoretical framework of our study. As we know, Cote d'Ivoire is a small country with small open economy in the sense that it's cannot influence prices in international market, imports prices are given in the world market and the prices are independent to the imports volume. Thus the imports demand depends on mainly real domestic income. However, the demand for imports can also be determined by real exchange rates. As we mentioned in our introduction Cote d'Ivoire is a member of UEMOA zone with fixed exchange rate regime from 1960 up to today. Therefore the standard analysis of exchange rate fluctuations and the trade balance utilizing the specification of the domestic demand for imports and the foreign demand for exports derived from a country utility maximization framework of (Samuelson, 1949) , (Mundell, 1962), (Fleming, 1962), (Dornbusch, 1976) and (Krugman & Miller, 1992). The most common definition of the real exchange rate take into account the prices ratio of tradable to non-tradable goods. Hence the real exchange rate was constructed as follow:

$$RER = \frac{eP*}{P} \tag{1}$$

Where e denotes the nominal exchange rate, P and P^* express respectively domestic price denotes foreign price. If we consider two countries A and B. Country A produces good 1 at home and country produces good 2 abroad. A simple theoretical model for the determination of the exchange rate is outlined as follow:

$$L_1 = \frac{X_{11}}{a_{11}} + \frac{X_{12}}{a_{12}} \;\; with\; \alpha > 0;\; \alpha + 1 - \alpha = 1 \tag{2}$$

$$L_2 = \frac{X_{21}}{a_{21}} + \frac{X_{22}}{a_{22}} \;\; with\; \beta > 0; \alpha + 1 - \beta = 1 \tag{3}$$

Where a_{ij} denotes the productivity of labor in country i in producing good j then α and β are the consumer preferences in country 1 and 2 respectively. Solving the model taking into consideration the household preferences

and firm's technology trade equilibrium requires the real exchange rate (RER) in the general equilibrium setting to be the price ratios in the two countries which reflects the ratio of the labor productivity in the two countries. The result is hence given as:

$$MRS_{12}^{1} = MRS_{12}^{2} = \frac{a_{11}}{a_{12}} = \frac{P_{11}}{P_{12}} = \frac{P_{21}}{P_{22}} = \frac{a_{21}}{a_{22}} = MRT_{12}^{1} = MRT_{12}^{2} \quad (4)$$

$$\frac{a_{12}}{a_{11}} P_{11} = P_{12} = P_{22} = \frac{a_{22}}{a_{21}} P_{21} \quad , \quad \frac{P_{22}}{P_{11}} = \frac{a_{12}}{a_{11}} \frac{a_{22}}{a_{21}} \quad (5)$$

Therefore, the real exchange rate should depend on relative productivity of labor. Here, MRS and MRT represent respectively marginal rate of substitution and marginal rate of technical substitution then we assume that the consumer chooses a bundle of goods that maximizes utility subject to a budget constraint. The utility maximization principle we use in our model is that the compensated own price effect should be negative. We assume also that Cote d'Ivoire is small open economy and price taker in the global market. According (Rose & Yellen, 1989) studies, the country's trade balance behavior is built into a reduced form function directly depending on the real exchange rate, foreign income and real domestic income. Therefore the functional form of the import and export demand models is written as follow:

$$X_t = (\frac{P}{eP^*})^{\rho} . (Y_t^*)^{\sigma} \quad (6)$$

$$M_t = (\frac{eP^*}{P})^{\mu} . (Y_t)^{\pi} \quad (7)$$

Where X and M represent the volume of exports and imports, e denotes the nominal exchange rate and P, $P^*$and Y,Y^* express the domestic and foreign price levels and incomes respectively,σ and π are the real exchange rate elasticities for exports and imports then ρ and μ measure the income elasticities for imports and exports. As illustrated above, the model estimates elasticity then, if we incorporate natural logarithm both side, our export and import demand models can be written in this form:

$$LnX_t = \rho[LnP_t - LnP_t^* - Lne_t] + \sigma LnY_t^* \quad (8)$$

$$LnM_t = \mu[LnP^* - Lne_t - LnP_t] + \pi LnY_t \quad (9)$$

Here, $[LnP_t^* - Lne_t - LnP_t]$ measures the natural logarithm of real exchange rate. If we consider that the trade balance TB is defined as the ratio between exports and imports we have:

$$LnTB = \pi LnY_t + \sigma LnY_t^* + \varphi Lne_t \quad (10)$$

Where $\varphi = -(\rho + \mu)$ and the coefficient φ indicates whether the ML conditions is fulfilled, then π *and* σ are assume to be negative. Precisely, σ *and* π are positive thus whenever $\varphi > 0$ mean that a depreciation or devaluation of real exchange rate appears to improve trade balance over time. In another words, an increase of real exchange rate will improve the balance of trade. Therefore our study examines whether this reality is justify by Cote d'Ivoire's export and import pattern. In this case the study utilizes and develops similar models used by (Rose A. K., 1991) and (Singh T. , 2002). Their studies demonstrate that the trade balance is a function of real exchange rate and the domestic and foreign real income. Hence, a log-linear form of the model can be stated as follow taking into account dummy variables (D_t) to capture all policies reform:

$$LnTB = \theta_0 + \theta_1 LnRER + \theta_2 LnY_t + \theta_3 Y_t^* + \varepsilon_t + \emptyset D_t \quad (11)$$

Where $LnRER, LnY_t, LnY_t^*$ are logarithm of real exchange rate, real domestic income of Cote d'Ivoire and world real industrial production index (proxy of trade partner's income). The empirical foundation of our study suggests

that the exports and imports increases as the real income of the trade partners and domestic income rises respectively, and vice versa. In that case we could expect $\theta_2 < 0$ and $\theta_3 > 0$. However, imports may decline as income increases if the real income rises due to an increase in the production of import-substitute goods, and in that case we would expect $\theta_2 > 0$ and $\theta_3 < 0$. The effect of changes in real effective exchange rate on balance of trade is ambiguous. Thus, θ_1 could take any sign, positive or negative. In general speaking, if real depreciation/devaluation occurs, which causes the real effective exchange rate to increase, the exports go up, the imports fall as a consequence and it improves the trade balance.

4.2. Estimation methods and data

The first step is to visually examine the data to ensure that the equation we estimate are not spurious, it's important to test for nonstationarity. In another words, the time series properties of the variables need to be examined in order to determine their characteristics. In order to overcome this problem, we use the method developed by (Dickey & Fuller, 1979) and (Phillips–Perron, 1988) to test the existence of unit root in order to establish the properties of individual series.

After performing the unit root test and confirmed that all the variables are of the same order of integration, the study proceeds on to test the long-run relationship of economic variables, named cointegration test .We carried out the method developed by (Johansen, 1988) and (Juselius, 1990) which applies maximum likelihood to a Vector Auto Regression (VAR) model assuming that the errors are Gaussian. The concept of cointegration implies that, if there is a long run relationship between two or more non-stationary variables then, if the variables are integrated of order one; that is, $I(1)$, the static model is estimated for cointegration regression. In generally speaking, testing the existence of this long-run relationship between economic variables requires a $pth - order$ structural and dynamic (VAR) model on the variables under consideration which, in keeping with Granger representation theorem, can be written as an unrestricted Vector-Error Correction VEC involving up to p lags in this form:

$$\Delta LnTB_t = \beta_0 \sum_{j=1}^{p} \delta_k \, \Delta LnTB_{t-j} + \sum_{j=1}^{p} \lambda_k \, \Delta LnY_{t-j} + \sum_{j=1}^{p} \varphi_k \, \Delta Y^*_{t-j} + \sum_{j=1}^{p} \phi_k \, \Delta LnRER_{t-j} + \psi\left[LnBT_{t-1} - \hat{\theta}_0 - \hat{\theta}_1 LnY_{t-1} - \hat{\theta}_2 LnY^*_{t-1} - \hat{\theta}_3 LnRER_{t-1}\right] + \varepsilon_t \quad (12)$$

Where ψ measures the adjustment speed between the short-run and long-run disequilibrium and is vector error correction term (ECT) as independent variable in the estimation process will cover all the long-run information that was lost in the original estimation process, Δ is the first difference operator and ε_t is a purely white noise term. The ECT should have a negative sign and significantly different from zero. The negative sign of ECT means that the deviation event between actual and long-run equilibrium level would be adjusted back to the long-run relationship in the current periods to clear this discrepancy. Finally we perform the Granger-Causality test in order to examine the short-run relations among the four variables used in balance of trade regression equation. To solve this problem, we utilize the technique developed by (Granger, 1969) and improve later by (Sims, 1972).If we consider for example suppose 2 variables, say $X_t and\ Y_t$, affect each other with distributed lags. The relationship between those variables can be captured by a VAR model .Then, if we want to test whether X_t causes Y_t, we analyze that how much of the present Y_t can be illustrated by lagged values of Y_t and X_t. In the Granger causality we test null hypothesis that X_t does not granger causeY_t; and if we can reject the null hypothesis, it means that X_t does Granger causeY_t. So the bivariate regression form for the Granger causation is written as follows:

$$Y_t = \lambda_0 + \sum_{i=1}^{l} \lambda_i \, Y_{t-i} + \sum_{i=1}^{l} \mu_i \, X_{t-i} + \upsilon_t \quad (13)$$

$$X_t = \lambda_0 + \sum_{i=1}^{l} \lambda_i \, X_{t-i} + \sum_{i=1}^{l} \mu_i \, Y_{t-i} + \varepsilon_t \quad (14)$$

Where the joint hypothesis of F-test based to Wald statistics for each equation are:

$$\mu_0 = \mu_1 = \mu_2 = \mu_3 = \cdots = \mu_l$$

The annual data utilized for our study was selected from the International Financial Statistics (IMF-FS-CDROM) published by the International Monetary Fund (IMF) covering the whole period 1975-2007 because quarterly data of some relevant variables are not available. National Y_t is GDP volume index numbers and foreign income Y_t^* is

defined by GDP volume index of France taken as the proxy for world output. TB is constructed as the rate volume of exports and volume of imports and the real exchange rate (RER) is computed as the ratio of foreign price proxied by consumer price to domestic consumer price multiplied by the nominal exchange rate of the domestic currency. Note that all variables are expressed in logarithmic forms and data are expressed in Cote d'Ivoire's local currency (CFA).

5. Empirical result and interpretation.

5.1. Empirical results.

In this section, we first run the univariate augmented Dickey-Fuller (ADF) and Phillip-Peron (PP) unit root tests for each variable that enters the multivariate model following the methodology implemented by (Dickey & Fuller, 1979) and (Phillips–Perron, 1988) testing for the significance of trend and no trend with non-stationary and assuming that the choice of lags is based to guarantee non-residual autocorrelation. The results over the period are reported in table 1.The over all test shows that we fail to reject the stationary null hypothesis base on ADF and PP test at level excepted for TB. However the tests indicate that all variables contain a unit root at level while they are all first difference stationary. Thus, according the empirical foundation, we conclude that all variables follow the $I(1)$ process.

Turning to the cointegration test, we follow the popular procedure developed by (Johansen, 1988) and (Juselius, 1990). As we mentioned earlier the method is based on the statistic values such us maximum eigenvalue (λ_{max}) the trace statistics (λ_{trace}) or the likelihood ratio (LR).These statistics are utilized to detect the number of cointegrating vectors between trade balance (TB) and it determinants. To this purpose, we firstly proceed by finding the appropriate lag-length in order to make sure the gaussian structure of the residuals in the vector-error correction model ($VECM$). To overcome this problem, we use the criteria developed by Akaike Information criterion (AIC) and Schwarz Bayesian Criterion (SBC). On the basis of these information criteria, the best lag order is $k = 6$ for the periods 1975-2007.

Thirdly, we perform the cointegration test in order to determine the number of cointegrating vectors for different combinations of variables; table 2 displays the results. Finally, after getting the long-run cointegration relationship using (Johansen, 1988) and (Juselius, 1990) procedure, the error-correction model (ECM) can be expressed and estimated with a more appropriate simple dynamic representation of the (ECM) equation (12). Thus, an error correction term lagging one period error-correction term (ECT_{t-1}) is included as one of the independent variables in the general over parameterized error correction model of maximum sustainable yield equation. This term capture the long run relationship by attempt to correct deviations from the long run equilibrium path. Its coefficient can be interpreted as the speed of adjustment or the amount of disequilibrium transmitted each period to amount of trade balance ($LnTB$). Results on table 4 represents the estimation of the over parameterized model. As shown in the general model table 4 (we don't display this table in our study because space problem but available by the author upon the request), most of the insignificant variables whose T-Statistics is less than 2, have been eliminated without losing valuable details and will not appear in the preferred model. The only significant variables (whose T-Statistic is greater than or equal to 2) will be appearing in the preferred model as it is shown in table 5. Finally, the resultant model can be checked by performing diagnostic tests on the residuals.

Prior examining the standard cointegration test and the error-correction model (ECM) in order to analyze for the existence of an equilibrium relationship between the trade balance and its determinants, we continue our study by exploring the presence of autocorrelation in the error terms of a regression model. The Engel's (Engel F. R., 1982) procedure allowed us to investigate the autocorrelation that occur in the variance of the error, rather than in the error themselves. To observe this autocorrelation Engel developed the Autoregressive Conditional Heteroskedasticity ($ARCH$) model, the basic foundation of this theory is that the variance of ε_t depends on the size of square error term lagged one period that is ε_{t-1}^2 . The results of all parsimonious equation and diagnostic test are reported in table 7. The diagnostic tests refer to the $pth - order$ Autoregressive Conditional Heteroskedasticity test ($ARCH$) ,the general Heteroskedasticity test (White) and the Lagrange multiplier test (LM) developed by (Breusch, 1979) and (Godfrey, 1979).

5.1. Interpretation.

In so doing, we performed univariate augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) unit root tests for each variable that enters the multivariate model following the decision process proposed by (Dickey & Fuller, 1979) and (Phillips–Perron, 1988) testing for the significance of trend and no trend with non-stationary and assuming that the choice of lags is based to guarantee non-residual autocorrelation. The results over the period 1975-2007 reported in table (1) fail to reject the null hypothesis at level based on the tests mentioned above. Therefore, $LnY, LnY^*$and $LnRER$ contain a unit root in their levels form but not in their first differences form so they are integrated of order one, *I (1)* process*,* while $LnTB$ is stationary in levels.

In addition, the second step was to perform the cointegration test using the famous method developed by (Johansen S. , 1988) and (Juselius K. , 1990). We found in our analysis that trade balance ($LnTB$) , real exchange rate($LnRER$) ,domestic income (LnY) and foreign income (LnY^*) are cointegrated at the 5% level of significance. Both the maximum eigenvalue (λ_{max}) and the trace statistics (λ_{trace}) tests identify a unique statistically significance vector with ($\lambda_{max} = 0.968024, \lambda_{trace} = 226.7759$) see table 2. However, we reject the null hypothesis that long-term relationship exist between Trade balance ($LnTB$) and it main determinants when the real exchange rate is employed as the basic determinant of the trade balance. Moreover, our preferred model displays very meaningful result thus real exchange rate ($LnRER$) domestic income (LnY)and foreign income (LnY^*) are all statistically significant at conventional significance levels 1 %, 5% even at 10% level table 5. The estimated cointegrating vectors are giving economic meaning by the normalized equation on trade balance. Note that the normalization equation is only conducted if nonzero vector or vectors are confirmed by the cointegration test. The results of the normalized cointegrating vector tests are shown in table 3.In fact, the normalized equation with $LnTB$ indicates more meaningful result with real exchange rate elasticity with negative coefficient (0.892045) significantly different to zero, negative sign domestic income (LnY) elasticity (1.317524) also positive elasticity (-2.648279) for foreign income LnY^*. Hence, according our empirical suggestions mentioned earlier, if we use trade balance as dependant variable, we fail to reject the null hypothesis of single cointegration at 5% significance level. This mean that the export and import demands function in Cote d'Ivoire are stable. Therefore, the long-run independent variables utilize in specifying the trade balance function for this study seems to be good. Regarding Jansen ,Thornton and (Dickey, 1991), the vector that makes economic sense is that the estimated coefficients are close to and have the same signs as those predicted by economic theory. According (Jansen, 1991) and (Dickey & Thornton, 1991) cointegration analysis does not give estimates with structural interpretation regarding the magnitude of the parameters of the cointegrating vectors. Because cointegrating vectors merely imply long run, stable relationships among jointly endogenous variables, they generally cannot be interpreted as structural equations. Therefore, we continue our study by analyzing more deeply the effects of real exchange rate on trade balance in Cote d'Ivoire.

Following the dropping out of insignificant variables in the general model without loosing valuable information; the short-run dynamics of the long-run trade balance function is analyzed by computing an error-correction model (ECM) with lags length ($k = 6$) and report a significance F-test statistics which implying that there is an improvement in the overall significance of the model table 5. The result displays a correct sign (negative) meaningful and relatively higher ECT_{t-1} coefficient (-0.30737). These signify that the adjustment process to an exogenous shock is rather higher. In another words, it would take 30.7 of the year of trade balance ($LnTB$)to come to equilibrium if an econometric shock of import and export demands occurred both in domestic and foreign market. Furthermore, cointegration among trade balance ($LnTB$) and its determinants can also be confirmed by the significance of the lagged error–correction term (ECT_{t-1}) at the conventional level 1% and 5%. This evidence from the test demonstrate that the real exchange rate is a very important variable for long-run cointegration estimation vector but produce also a strong significant short-run impact on trade balance ($LnTB$) function. In the fourth step of our analysis, we run the Granger-causality following the method of (Granger, 1969) and (Sims, 1972). The Granger causality test statistic reveals that the real exchange rate ($LnRER$) real gross domestic income(LnY) and real foreign income (LnY^*) Granger cause the trade balance of Cote d'Ivoire see table 6. It also gives another idea about Cote d'Ivoire economy that the real exchange rate causes the real gross domestic income of Cote d'Ivoire to change. Real gross national expenditure causes the world real income to change which implies that Cote d'Ivoire is longer a very tiny economy.

Turning to the J-curve analysis, we refer to (Onafowora., 2003) investigation on the Marshall-Lerner condition using Impulse Response Function (IFR) and demonstrate that the Marshall-Lerner condition holds in the long-run in three

ASEAN countries: Indonesia, Malaysia and Thailand. This study also explores the response of the trade balance to the real exchange rate of Cote d'Ivoire through Impulse Response Function (IFR) analysis regarding (Onafowora., 2003) methodology. The results reveal that depreciation or devaluation leads to an unexpected fall in exports earning and rise in imports cost for Cote d'Ivoire immediately after the currency adjustment. Hence the trade balance deteriorates instantly after depreciation or devaluation and then starts improving from the second period and eventually goes to the baseline. The combined results support the Marshall-Lerner condition through the J-curve idea see figure1.We should also know that depreciation or devaluation of currency does not always necessarily improve the balance of trade for three reasons as follow: i) if the Marshall-Lerner condition, the sum of the elasticities of demand for exports and imports is greater than one, does not satisfy, currency devaluation cannot improve the balance of trade, despite it is sufficient not necessary condition for improvement of trade balance. ii) The trade balance will improve following devaluation if the product of demand elasticities exceeds that of supply elasticities. iii) if the considered country finances its current account deficit by foreign loan, both the principle and interest would increase in home currency term with the devaluation/depreciation of currency and therefore, advantage of devaluation would be eaten up by the repayments of its previous commitments (Williamson, 2005).

Finally we conducted the autoregressive conditional heteroscedasticity test ($ARCH$), the general heteroscedasticity test (White) and the Lagrange multiplier test (LM) developed by (Breusch, 1979) and (Godfrey, 1979) .The parsimonious equations and diagnostic test results are summarized in table 7 .The computed Breusch–Godfrey Lagrange multiplier (LM) statistic shows no evidence of serial correlation to the first order in the VAR residuals. The Ramsey's RESET (Ramsey, 1969) statistics revealed no serious misspecification of variables. The models also passed the (Jarque-Bera, 1987) test for normality with little pain but acceptable. The model pass the standard tests with negative error-correction term (ECT_{t-1}) coefficient (-0.30737) with a significant higher magnitude and suggests that the speed of adjusting to long-run changes is higher therefore very acceptable as we mentioned earlier. This show that the trade balance is quite stable. In order to check the stability of the coefficients of our model, we computed the $CUSUM$ and $CUSUMQ$ square (Brown and Durbin, 1975). The cumulative sum of residuals plot is reported in figure 2 and 3. Therefore following the literature, we partially conclude that the real exchange rate ($LnRER$) has the long-run economic impacts on ($LnTB$) fluctuation in Cote d'Ivoire.

6. Conclusion

In this paper we assess the long and short run effects of real exchange rate on the Cote d'Ivoire's trade balance in a long period from 1975 to 2007. The (Johansen S. , 1988) and (Juselius K. , 1990) test confirm the presence of a long run cointegrating relationship among the variables used for this study. The study also reveals that the real exchange rate has a significant impact on balance of trade of Cote d'Ivoire both in the short-run and long-run. The Granger causality test confirms the causal relation between exchange rate and balance of trade of Cote d'Ivoire. The impulse function response (IFR) also supports the results above mentioned by showing positive impact of real exchange rate on trade balance in the long run. By using VAR-based cointegration tests and impulse response function (IFR), we show that (ML) condition is fulfilled in the periods including fixed exchange rate regime policy. The study clearly demonstrates that real devaluations of exchange rate in Cote d'Ivoire have been positively associated with improvement of balance of trade. Hence, devaluation of currency as a whole seems to be beneficial for Cote d'Ivoire exports. Therefore, researchers don't encourage continual devaluation because highly volatile exchange rate makes macroeconomic variables such as inflation, interest rate and broad money supply unstable.

In addition, reliable trade partners on the exchange rate are important for the stability of trade flow. As Cote d'Ivoire currently operates its exchange rate policy under fixed exchange rate system, a stronger official market will be necessary so that financial market actors cannot bring a total collapse in the currency market. It needs to make sure the lower degree pass-through from exchange rate to inflation as well. In another words, undervalued exchange rate regime could be unprofitable for Cote d'Ivoire and the region. With acceleration of regional integration in West Africa, Cote d'Ivoire has to compete with some countries such as Ghana, Nigeria and Benin. In this way, the policy makers should think how to increase the country's productivity capacity in order to be more competitive in global market.

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Table 1: Univariate Unit Root tests

Test/variables	ADF statistic		Phillips-Perron Statistic	
	No trend	Trend	No trend	Trend
Level				
LnTB	1.135407	-3.3078***	1.586052	-4.02448
LnRER	-0.516662	-2.332202	-0.529878	-2.46182
LnY	1.726391	-2.864138	2.8067	-3.089223
LnY^*	1.016514	-3.449721*	4.188846	-4.565913
First Difference				
ΔLnTB	-4.488319*	-4.583222*	-6.565776*	-6.714609*
ΔLnRER	-4.028047*	-3.988498*	-5.731605*	-3.988498*
ΔLnY	-3.423516*	-3.723425*	-3.035515*	-3.4782***
ΔLnY^*	-1.910111*	-1.01299**	-2.486095*	-1.98381***

Source: Computation from data used in Regression Analysis.

The table shows univariate unit root tests. The notation $(LnTB), (LnRER), LnY$ and LnY^* indicate respectively the Trade Balance, Real Exchange Rate, National Real Income and Foreign Income. The Δ denotes first-difference derivation. The asterisks *, **, and *** denote statistical significance at 1%, 5%, and 10% levels, respectively. McKinnon (1980) critical values are used for rejection of the null unit root.

Table 2: Johansen Cointegration test (Sample 1975-2007)

Null hypothesis	Alternative hypothesis	Maximal Eigenvalue test (λ_{max})	Likelihood Ratio LR/Trace test Statistics (λ_{trace})	5% critical Value (CV)	1% critical Value(CV)
r=0	r=1	0.968024	226.7759	54.64	61.24
r≤1	r=2	0.947949	130.3786	34.55	40.49
r≤2	r=3	0.735501	47.62369	18.17	23.46
r≤3	r=4	0.309907	10.38602	3.74	6.4

Source: Computation from data used in Regression Analysis.

This table displays Johansen tests for cointegration. The λ-max and λ-trace *(L.R)* are Johansen's maximum eigenvalue and trace eigenvalue statistics for testing cointegration. Critical values (*C.V.*) denotes rejection of the hypothesis at 5 %(1%) significance level, L.R. test indicates 4 cointegrating equation(s) at 5% significance level.

Table 3: Normalized Cointegrating Vectors.

Variables	Cointegrating Vectors	Coefficients
C(constant)	0.417238	
LnTB	1.000	
LnRER	0.892045	[0.66327]
LnY	1.317524	[0.58915]
LnY^*	-2.648279	[0.68138]
Trend	0.021792	

Source: Computation from data used in Regression Analysis.
Note: This table presents the cointegrating vectors with the coefficients on the trade balance normalized to one. The value in parentheses denotes the coefficients.

Table 5: Preferred estimated Error-Correction Model regression with lags length *k=6*

Independent variable		Coefficients	Standard Error
$C(constant)$		-4.67388**	2.328009
$\Delta LnRER_{t-5}$		-1.15014***	0.361753
ΔLnY_{t-4}		-1.32879***	0.486577
ΔLnY^*_{t-2}		8.714269***	2.464694
ΔLnY^*_{t-5}		-10.9937***	2.605822
ΔLnY^*_{t-6}		7.051717***	2.089721
ECT_{t-1}		-0.30737***	0.151829
R^2	0.699889		
$\bar{R}^2$	0.605117		
RSS	0.678342		
DW	1.181748		
$F.statistic$	7.38497		
$Prob(F.statistic)$	0.000347		
$Likelihood\ Log$	10.50819		
Observation	33		

Source: Computation from data used in Regression Analysis.
Note: R^2= 0.6989 imply that the model is good fit. F-test result indicates the overall significance of the model. The asterisks ***, ** and * implies statistically significant at 1%, 5% and at 10 % level respectively.

Table 6: Pairwise Granger Causality Tests (F-statistic; sample: 1975-2007; lags: 2)

Variables	$\Delta LnTB_t$	$\Delta LnRER_t$	ΔLnY_t	ΔLnY_t^*
$\Delta LnTB_t$		1.07141***	0.30424**	1.66178***
$\Delta LnRER_t$	3.31587***		0.03802**	0.10513**
ΔLnY_t	3.24958***	0.61744***		5.70896***
ΔLnY_t^*	3.15731***	1.02296***	1.0907	

Notes: The F-statistic values of overall significance are given in the table. The asterisks (**) reject the null hypothesis that horizontal variable does not cause the respective vertical variable to change at 5% level of significance. The asterisks (***) reject the null at 1% level of significance.

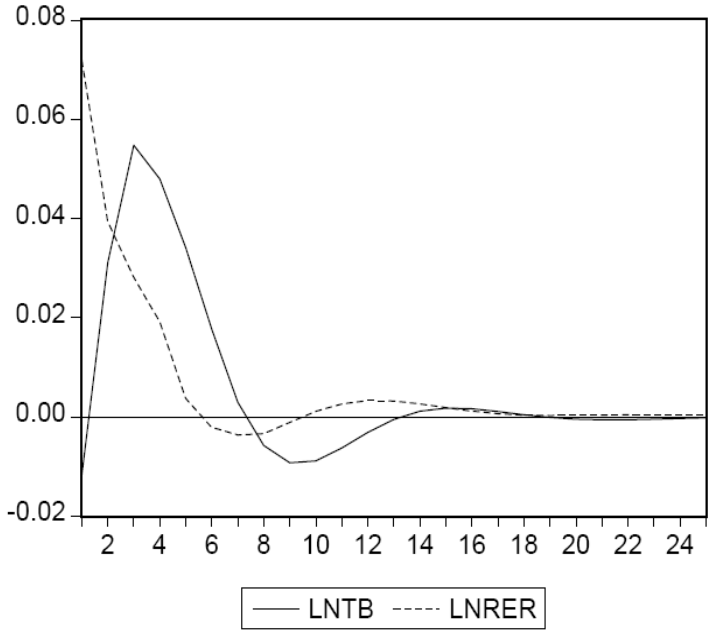
Table 7: Diagnostic Check for Model Appropriateness

$$\Delta LnTB_{t-1} = -4.67388 - 1.15014\Delta LnRER_{t-5} - 1.32879\Delta LnY_{t-4} + 8.714269\Delta LnY_{t-2}^* - 10.9937\Delta LnY_{t-5}^* + 7.051717\Delta LnY_{t-6}^* - 0.30737ECT_{t-1}$$

$LM(1) = 2.394972$	$DW = 1.181748$
$ARCH(1) = 2.372470$	$F(statistic) = 7.38497$
$R^2 = 0.699889$	$WHITE = 1.708539(0.191175)^{**}$
$\bar{R}^2 = 0.605117$	$Jarque - Bera = 0.383712(0.825426)^{**}$
$SSR = 0.68507$	$Reset - Ramsey = 1.866990(0.188648)^{**}$

Note: $R^2 = 0.699889$ imply that the model is good fit. F-test result indicates the overall significance of the model. The LM (1) test is the Lagrange Multiplier test for detecting autocorrelation where the null hypothesis is 'no-autocorrelation'. This test examines up to 1rst order serial correction and rejects the null hypothesis at 5% level of significance. The null hypothesis of 'autoregressive conditional heteroscedasticity (ARCH) test is: 'no heteroscedasticity'. Normality test is χ^2 based tests, which assumes that residual contains all the properties of classical linear regression model. Hetero test is F statistic based 'White test' which assumes 'no heteroscedasticity' in the regression. Regression Error Specification (RESET) tests assumes that 'regression coefficients are significant. The asterisk (**) denotes the values of probability.

Response of LTB to LREER



Response of LNREER to LNTB

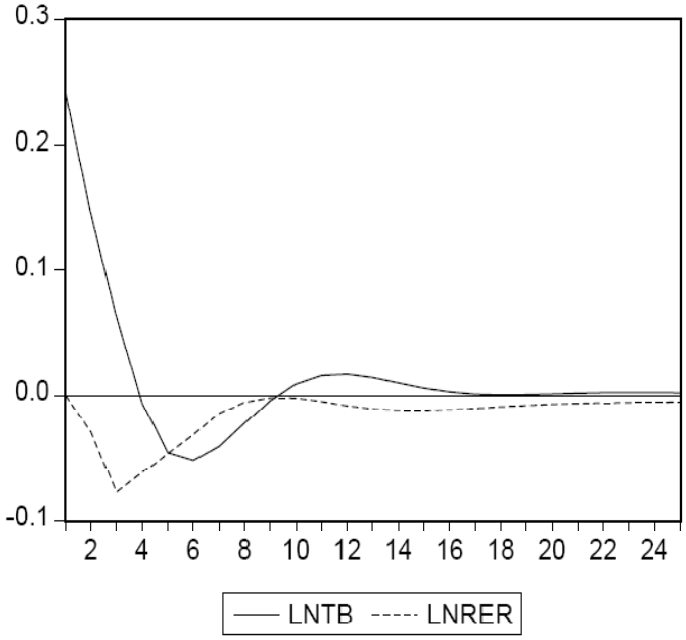


Figure 1: Impulse Response Function (standard error based) Trade Balance (LNTB) to Real Exchange Rate (LNRER) and, Real Exchange Rate (LNRER) to Trade Balance (LNTB)

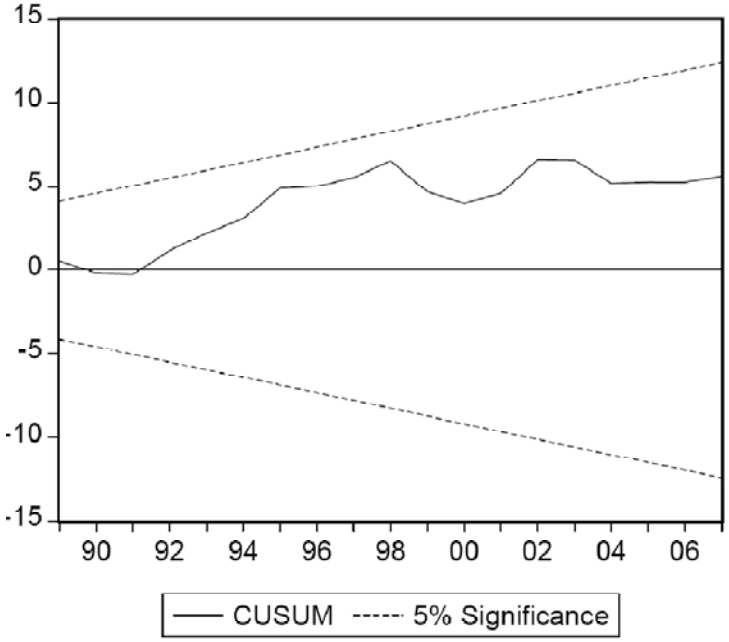


Figure 2. Plot of Cumulative Sum of Squares of Recursive Residuals for CUSUM 5% Significance

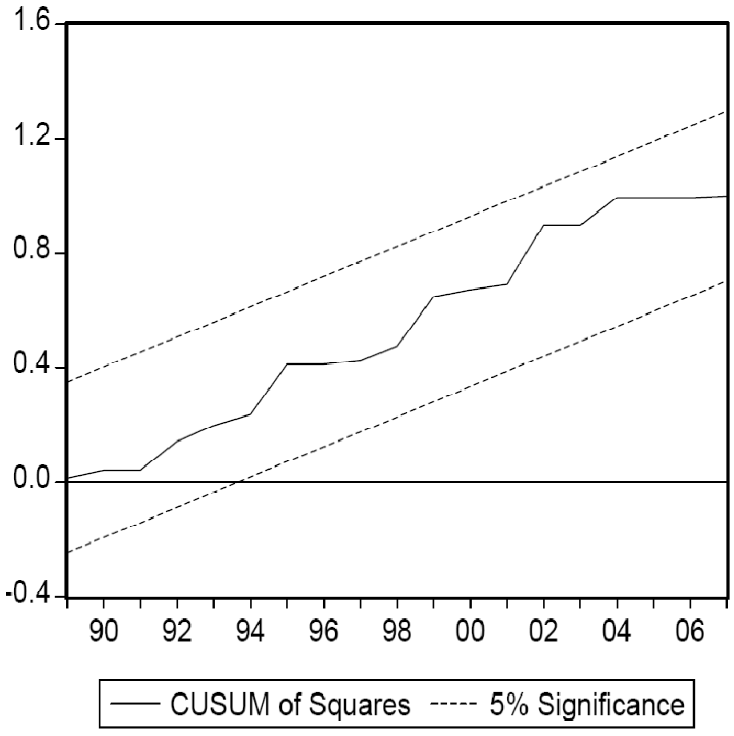


Figure 3. Plot of Cumulative Sum of Squares of Recursive Residuals for CUSUM of Squares 5% Significance