

# Real Exchange Rate and Foreign Direct Investment in Sub-Saharan Africa

## Some Empirical Results

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*Abstract:* Despite the well acknowledged importance of foreign direct investment (FDI) and efforts of sub-Sahara African (SSA) countries at attracting it, the region remains the least destination for FDI globally. Of course, several studies have endeavored to examine the determinants of FDI in this region. This study contributes to the literature by examining a possible determinant of FDI that has received less attention in the literature: real exchange rate (RER) movements. This paper examines this relationship with a view to determining the extent to which real exchange rate movements stifle FDI inflows in selected SSA countries, employing the Granger causality and simultaneous estimation techniques. The use of simultaneous equation is informed by the theoretical and empirical inconclusiveness on the relationship between movements in RER and FDI. The Granger Causality test further provides insight on the causal direction of the variables. Whereas the causality tests suggest statistical dependence between RER movements and FDI for a few of the countries, the regression analyses show a statistically significant relationship between these variables. While the inclusion of pre-reform period in the study may have contributed to these results, the general picture emerging is that FDI flows are sensitive to REER movements in SSA.

*Keywords:* FDI, real exchange rate, Granger causality, system estimation, sub-Saharan Africa.

### *Tasa de cambio real e inversión extranjera directa en África subsahariana: Algunos resultados empíricos*

*Resumen:* A pesar de la reconocida importancia de la inversión extranjera directa (FDI, por sus siglas en inglés) y de los esfuerzos de los países africanos al sur del Sahara (SSA, por sus siglas en inglés) para atraerla, la región sigue siendo el último destino de la FDI a nivel global. Desde luego, varios estudios se han ocupado de examinar los determinantes de la FDI en esta región. El presente estudio contribu-

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ye al examinar un posible determinante de la FDI que ha recibido menos atención en la literatura: los movimientos de la tasa de cambio real (RER, por sus siglas en inglés). Este documento examina esta relación con miras a determinar la medida en que los movimientos de la tasa de cambio real desalientan la entrada de flujos de FDI en determinados países del SSA, mediante el empleo de la causalidad de Granger y de técnicas de estimación simultánea. El uso de ecuaciones simultáneas se caracteriza por la falta de una conclusión, tanto teórica como empírica, de la relación entre los movimientos de la RER y de la FDI. La prueba de causalidad de Granger provee un mayor entendimiento de la dirección causal de las variables. Mientras que las pruebas de causalidad sugieren dependencia estadística entre los movimientos de la RER y la FDI para unos cuantos países, los análisis de regresión muestran una relación estadísticamente significativa entre estas variables. Mientras la inclusión en el estudio del periodo anterior a la reforma puede haber contribuido a estos resultados, la visión general que emerge es que los flujos de la FDI son sensibles a los movimientos de la RER en el SSA.

*Palabras clave:* FDI, tasa de cambio real, causalidad de Granger, estimación del sistema, África al sur del Sahara.

*JEL Classification:* F21, F31, O24.

## Introduction

Volatile and dwindling inward foreign direct investment is a major feature of most Sub-Sahara African (SSA) countries. Although the region has benefited from the global rise in FDI inflows, there exists and remains a large and widening regional disparity in the pattern of flows between SSA and other developing regions, as the region continues to have the least global share. For instance, while Asia received about 22 per cent of the total FDI inflows in 2004, SSA received just about 2 per cent. On the average, SSA's share of global annual inflows of FDI amounted to 1.2 per cent between 1990 and 2000. This figure contrasts sharply with an annual average of about 18 per cent for Asia. Also, while the average annual global share of FDI inflows between 1970 and 2005 was 14 per cent and 10 per cent in Asia and Latin America, respectively, SSA's share was only about 2 per cent during the same period. Moreover, while Latin America's share of world FDI inflows rose by 11 per cent between 2005 and 2006, SSA experienced a fall from a global share of 3 per cent to 2.7 per cent (UNCTAD, 2007).

While several studies have sought to examine the sources of such lack of competitiveness for FDI, several factors have been identified (see, for instance, Ajayi, 2006). However, less attention has been devoted to the role of real exchange rate movements as a possible source of SSA's lack of competitiveness for global FDI flows. Yet, the breakdown in the Bretton Woods system of fixed exchange rates in the 1970s has resulted in wider fluctua-

tions in both nominal and real exchange rates in both developed and developing countries (Maskus, 1986). These fluctuations became more pronounced in SSA from the early 1980s, when most of the countries adopted different types of flexible exchange rate system. On average, The International Monetary Fund's (IMF) International Financial Statistics (IFS) data revealed that exchange rate for the region has fluctuated between 17 and 154 per cent since 1970. As we do know, the exchange rate movement is a major factor in the decision to engage in FDI.

There exists burgeoning theoretical and empirical literature on the relationship between real exchange rate and FDI for developed countries, with risks being a major channel (Froot and Stein, 1991; Cushman, 1985). The argument is that the risk and uncertainty engendered by exchange rate movements induce a risk-averse foreign investor to change his foreign investment decision. While so much has been done to investigate and establish this relationship for developed countries, little is known about the extent to which real exchange rate movements retard FDI in SSA. The aim of this paper is to examine this less investigated deterrence cause of FDI inflows into the SSA economies.

Following this introduction, section I provides background information on FDI and real exchange rate movements in the selected countries. Section II presents a review of the theoretical and empirical literature on the relationship between FDI and exchange rate movements. Section III gives insight on the empirical estimation procedures and data. Discourse on the empirical results is found in section IV, while section V concludes.

## **I. FDI and Real Exchange Rate in Sub-Saharan Africa**

Generally, it has been acknowledged that SSA has been consistently unable to attract much FDI compared to other regions of the world. In addition to this, FDI inflows to these countries have also been volatile and dwindling (Egwaikhide *et al.*, 2005). Figure 1 in the appendix reveals the movement in FDI inflows to the selected SSA countries. The data show that the flow of FDI to these countries was very low and stable in the 1970s. The average FDI inflow to these countries was 57.2 million US dollars between 1970 and 1979, with Nigeria having the highest average flow of 308.1 million US dollars, and Uganda the lowest, of about 0.5 million US dollars.

During the 1980s, a relatively low rise was observed in the average FDI inflow to these countries, with a figure of 87.1 million US dollars. All the countries experienced an increase in FDI inflows, except Ghana and South

Africa. However, the rise experienced by this group of countries differs across individual nations, with some of them experiencing a significant rise, while others a very modest one. Cameroon recorded the highest average rise from about 17 to about 206 million US dollars. The rise in FDI inflows to these SSA countries appears to be a reflection of FDI enhancing tendency of financial globalization.

The following decade (1990s) witnessed a slight drop in the average FDI inflows to the SSA countries. From the previous average flow of 87.1 million US dollars in the 1970s, the average FDI inflows to these countries fell to 75.3 million US dollars in the 1980s. This fall may not be unconnected with the mild recession experienced in the industrial countries during this period, given the fact that a greater percentage of the flows comes from these countries. Another possible explanation for this fall in FDI inflows was the region's unfavorable economic environment, which mostly resulted from incessant political and social upheavals and wars, insecurity of investment, lack of infrastructure, weak regulatory and legal institutions and an unpredictable macroeconomic environment. A particular example of the unpredictable macroeconomic environment is the erratic movement in the exchange rates of these countries, noted in the preceding section. Unsurprisingly therefore, the fall in FDI inflows to these countries coincides with the period when most of them adopted a flexible exchange rate policy that further increased the volatility of their real exchange rates.

Another notable feature of FDI inflows to SSA is the large inequality across countries (see table 1 in appendix). Specifically, South Africa and Nigeria attracted the greatest percentage of FDI inflows to the region during the period under review, with these countries attracting respectively a total of 6.6 and 5.0 billion US dollars of FDI in 2005. These values contrast sharply with the total inflows of 17.1 and 21.3 million US dollars for the Central African Republic (CAR) and Kenya, respectively. This seems to corroborate the view by some economists that resource-seeking is the major driver of FDI in SSA (see, e.g., UNCTAD, 2008).

Until the 1980s, most SSA countries were operating the fixed exchange rate system. While some of them had a completely fixed exchange rate, others operated the pegged system. However, from the 1980s onwards most of these countries began to adopt the flexible exchange rate system. This change in policy was informed by the increased popularity of flexible exchange rate based on superiority claim *vis-à-vis* the fixed rate regime. Another major motivation for this policy change was the IMF recommenda-

tion of structural adjustment policies to correct structural imbalances in these economies.

In addition, large swings in economic variables resulting sometimes from sudden policy changes and reversals led to the observed incessant changes in foreign exchange rates in this region. Moreover, rising and unsteady inflation rates in these countries further aggravated the movements of the real exchange rates.

## **II. Theoretical Issues and Literature Review**

The mechanisms through which the exchange rate level affect FDI flows have been examined in several theoretical and empirical studies. The general conclusion of these studies is that devaluation in the recipient country's currency stimulates inflows of FDI, and conversely, an appreciation leads to a reduction. Essentially, the literature identifies two main channels through which exchange rates impact FDI: wealth effect and relative production costs (Froot and Stein, 1991; Klein and Rosengren, 1994; Blonigen, 1997). Devaluation in the currency of a country receiving FDI leads to a reduction in local production costs in terms of foreign currency, raising the profits of export-oriented foreign investors accordingly. This suggests that higher returns naturally attract more FDI inflows. The wealth effect, which is the wealth of foreign investors relative to domestic investors, also rises following a devaluation because all production inputs become cheaper for the foreign investor whose capital is in a foreign currency, and encourages the acquisition of more domestic assets.

Many empirical enquiries have confirmed that there is a strong relationship between exchange rate level and FDI, and this prediction was first examined empirically by Makin (1974). The study concluded that the prevalent views in the 1960s that the United States was a permanent exporter of capital while countries like Germany and Japan were permanent importers of capital may be erroneous. He, however, noted that the observed direction of FDI flows could have been due to disequilibrium in exchange rates, and that the flows would then be slowed or reversed by the yen and mark upward revaluations and the dollar devaluation. This finding is consistent with the earlier prediction of Houthakker (1962).

An interesting feature of the relationship between exchange rate and FDI can be gleaned from the work of Hinshaw (1975). The study proposes that, if there are two countries, one inflating and the other non-inflating but both operate fixed exchange rates, as the former country's currency

becomes increasingly overvalued, exported goods would be removed one-by-one from its exporting schedule. Based on the same logic, goods previously produced only domestically would also one-by-one be added to the importing schedule. The expectation here is that, as these previously exported goods are removed from the export schedule, they would one-by-one be added to the list of industries for which direct investment abroad becomes the only profitable means of maintaining foreign markets. Also, the attractiveness for foreign investors to invest in the domestic economy would be eliminated one-by-one as each industry is unable to compete favorably with foreign competitors. However, if the domestic country devalues, such pressures are removed, and the relative profitability of foreign *versus* domestic production is accordingly adjusted. One basic weakness of this and other previous studies, however, is that they did not provide a systematic theoretical basis for this relationship.

Alexander and Murphy (1975) were set to fill this vacuum by providing a formal theoretical and empirical basis for modeling the relationship between exchange rates and FDI, using US data. This study developed and provided a relatively comprehensive analysis of the effects of exchange rate changes on capital flows overtime. The internal rate of return theory for the purpose of comparing alternative investment returns was explored in this study. It represents a theoretical reasoning which suggests that exchange rate devaluations in the host economy increase FDI in such economy. The results were presented under different assumptions about the type of investment and effects of parity changes. These results generally support the contention that US dollar devaluations induced FDI inflows into the economy.

Prodded by the submissions of Alexander and Murphy (1975), Kohlhaugen (1977) developed a theoretical relationship and examined empirically the effect of exchange rate changes on FDI. A simple model of relative profitability in the alternative production locations was employed to show that when a devaluation has no effect on domestic and foreign prices, it will unambiguously increase the relative profitability of domestic production *vis-à-vis* production through a foreign subsidiary. The conditions under which this effect would still hold when domestic and foreign prices are affected by exchange rate changes were articulated. In analyzing the effect of devaluation on the relocation decision of foreign investors, Kohlhaugen (1977) concluded that these enterprises tend to increase their production capacity abroad to meet domestic market needs, if the currency of the host country is devalued against the investor's home currency. How-

ever, this study does not seem to provide sufficiently rigorous basis for its conclusion because the theoretical framework employed for the analysis was borrowed from the theory of capital control, developed by Herring and Willett (1972), making it *ad hoc*.

A couple of other studies on the relationship between exchange rates and FDI were carried out during this same period. One of these, by Logue and Willett (1977), attempted to provide both theoretical and empirical evidence on this relationship in the case of the US, by employing the portfolio balance approach to FDI flows. It was established that devaluation of the dollar improved FDI inflows to the US economy. Commenting on the findings of this study, Stevens (1977) presented another model of the profit-maximizing international firm, showing that if direct investment is a function only of the profit maximizing level of output of the foreign subsidiary, a devaluation can have any effect on a country's direct investment abroad, depending on the various effects on the costs and revenues of the firm. In a further comment, Stevens (1977) investigated the response to expectations concerning future exchange rates and concluded that a foreign firm expecting currency devaluation in a foreign country of interest would defer FDI until after the devaluation, when it would be more profitable relative to exporting.

The apparent weakness in these previous works led Froot and Stein (1991) to provide a more rigorous theoretical basis for the now apparent relationship between exchange rate and FDI. The authors claimed that changes in the level of exchange rate may influence FDI because a depreciation of the exchange rate increases the relative wealth of foreign investors, thereby increasing the attractiveness of the host country for FDI as firms are able to acquire assets in the host country relatively cheaply.

Contrary to this position, it is often argued that what should matter for an investment decision is not the price of assets, but only their rate of return. This argument is based on the premise that when the host country's currency depreciates relative to that of the home country, both the price and nominal return of the assets in the host country currency falls. Given this scenario, it is believed that exchange rate movements should not affect FDI. Froot and Stein (1991) countered this argument with the submission that when capital markets are subject to information imperfections, exchange rate movements would, in fact, influence FDI. Information asymmetry causes a divergence between internal and external financing, making the latter more expensive than the former, since the lenders incur monitoring costs and thus lend less than the full value of

the asset. Given this scenario, if foreign investors hold their wealth in foreign currency, then a depreciation of the local currency will increase the wealth position of foreign agents relative to domestic agents, thereby encouraging foreign investors to invest aggressively in domestic assets. The authors used estimated results based on industry-level data on US inward FDI for the 1970s and 1980s to support their hypothesis. One very important and original contribution of Froot and Stein (1991) is the attention given to the relationship between exchange rate volatility and FDI at the sectoral disaggregated level. Data covering 13 sectors<sup>1</sup> between 1974 and 1987 were analyzed. They found that, in all the thirteen cases, exchange rate had a negative sign, with five of these being statistically significant. The strongest impact of exchange rate was evident in the manufacturing industries, especially chemicals. In addition, the study analyzed FDI inflows in the US, the UK, West Germany, Canada and Japan. The empirical findings revealed that the estimated coefficients of exchange rate were negative and statistically significant for the US and West Germany. These results further imply that exchange rate depreciation leads to greater FDI.

Campa (1993) differed completely from these earlier views of Kohlhagen (1977) and Froot and Stein (1991), putting forth the hypothesis that an appreciation of the host currency would, indeed, increase FDI into the host country.<sup>2</sup> Instead of focusing on the price of foreign assets, as Froot and Stein (1991) did, Campa's study was more along the lines of a production-based theoretical approach. According to him, a firm's decision to invest abroad depended on its expectations regarding future profit streams. Therefore, an appreciation of the host currency increases expectations of future profitability in terms of the home currency. To test this hypothesis, foreign investors entering the US in the 1980s were thoroughly examined. Findings revealed that an appreciation in the United States' exchange rate stimulated FDI.

Blonigen (1997) used data on Japanese acquisitions in the US from 1975 to 1992 to prove that real dollar depreciations increase foreign acqui-

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<sup>1</sup>These sectors are 1) all industries, 2) petroleum, 3) manufacturing, 4) food, 5) chemicals, 6) fabricated metals, 7) machinery, 8) other manufacturing, 9) trade, 10) finance, 11) insurance, 12) real estate and 13) other industries.

<sup>2</sup> Studies such as Dornbusch (1973, 1974), that recommend depreciation of the nominal exchange rate to redress real exchange rate appreciation, are inadvertently supporting this view because such a nominal depreciation would unambiguously worsen the appreciation, at least, in the short run.



sitions involving firm-specific assets by Japanese firms in the US. This argument differs from that of Froot and Stein (1991), although they both have the same outcome. While Froot and Stein (1991) showed that exchange rate movements are important because capital markets are imperfect, Blonigen (1997), on the other hand, found that exchange rate movements matter because, even though domestic and foreign firms may have the same opportunities to purchase firm-specific assets in the domestic market, foreign and domestic firms do not have the same opportunities to generate returns on these assets in foreign markets. Due to the unequal level of access to markets, exchange rate movements may affect the relative magnitude of FDI. Blonigen made the point that assets related to FDI should not be considered similar to assets such as bonds. However, such is not the case with assets related to FDI because the assets of a target firm could be firm-specific and may thus generate returns simultaneously in several markets without involving any foreign currency transactions (see also Klein and Rosengren, 1994; Dewenter, 1995).

Sazanami, Yoshimura and Kiyota (2003) is another significant study that examined the impact of exchange rate level on FDI at the sectoral level, with specific focus on the Japanese FDI to four machinery industries between 1978 and 1999. The study showed that real exchange rates had strong effects on FDI in industries with stronger effects in electronics and general machinery industries, than in precision or transportation industries.

One major weakness of these studies, however, is that none of them considered the destination of FDI. Therefore, Kiyota and Urata (2004) extended the existing works in two areas, using the Japanese FDI data. First, the study analyzed aggregate FDI by considering its destinations. Second, the analytical framework adopted by Froot and Stein (1991) and Klein and Rosengren (1994) was extended by incorporating the impacts of the failures of the law of one price between different markets on exchange rate volatility. Employing the feasible generalized least squares (FGLS) methodology with heteroscedastic error term and the assumption that the variance for each country differs, they found that, at the aggregate level, the movement in the exchange rate had a statistically significant impact on FDI. This finding corroborates Sazanami, Yoshimura and Kiyota (2003). However, industry level results indicated different findings in terms of the magnitude of the coefficients. In the case of FDI destination, the real exchange rate was found to have the same effects on FDI for all the East Asian countries and for ten out of eleven cases in the Latin American region. This emphasized that overvaluation of the host country's currency

discourages Japanese FDI, thus stressing the need to maintain a stable exchange rate and avoid overvaluation in order to attract FDI.

It is noteworthy from this survey that studies exploring the relationship between exchange rate and FDI in SSA are very scarce. It was only in a recent study that Mwega and Ngugi (2005) considered the effects of the exchange rate level on FDI inflows in Kenya. The results showed that real exchange rate depreciation has a positive effect on FDI inflows in the country. This supports the proposition that exchange rate depreciation attracts FDI inflows to host economies; quite the opposite of the view represented by Campa (1993).

Another recent study based on the experiences of African economies is Ogunleye (2008). This study examines the effects of both the movement in the levels and volatility of exchange rate on FDI inflows in nine selected African countries. Consistent with the submission in Mwega and Ngugi above, the study generally finds that exchange rate depreciation induces FDI inflows, while appreciation retards it. On the other hand, the impact of exchange rate movements on FDI is found to be significant only in countries with large FDI inflows.

In summary, there appears to be a lack of clear-cut direction on the effect of appreciation and depreciation in the host country's exchange rate on FDI inflows. However, the nature of the effect of real exchange rate on FDI appears to depend on the nature and motive of the investment and the risk behavior of the investor.

### **III. Data Issues and Estimation Procedure**

Given the focus of this paper, FDI and real exchange rate are the prominent data required for the analysis. The FDI data used in this study is real and scaled as a percentage of GDP. This data is sourced from the United Nations Conference on Trade and Development (UNCTAD) database. The exchange rate data is the real effective exchange rate. This variable is the nominal effective exchange rate<sup>3</sup> divided by a price deflator or index of costs, and is based on a nominal rate adjusted for relative changes in consumer prices. This data is extracted from the International Monetary Fund's International Financial Statistics, September 2007. Our data on domestic and foreign inflation rates is measured as consumer price index, which reflects changes in the cost to the average consumer of acquiring a

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<sup>3</sup>The nominal effective exchange rate is a measure of the value of a currency against a weighted average of several foreign currencies.

basket of goods and services that may be fixed or changed annually. Interest rate is measured in real terms as the interest rate charged by banks on loans to prime customers, less the inflation rate. GDP is similarly measured in real terms, and is sourced from the World Bank's World Development Indicators CD-ROM, 2007.

The data required for this analysis are time-series annual observations, spanning 1970 to 2005 for both the selected SSA countries and their foreign investment partners. The SSA countries are Botswana, Cameroon, Central African Republic, Ghana, Kenya, Nigeria, South Africa and Uganda. Specifically, the variables used include the consumer price index ( $\pi$ ), foreign CPI ( $\pi^*$ ), interest rate differential ( $i-i^*$ ) [which measures the interest rate difference between the OECD countries (high and non-high income) and the respective countries], real GDP (RGDP) and real interest rate (RINTRT). The OECD countries are considered because they are the prominent trade partners of the selected SSA countries.

Next, we present the estimation procedure for examining the causal relationship on the likely interdependence between FDI and real exchange rate, employing the vector autoregressive (VAR), time-series Granger causality and simultaneous estimation techniques. The most widely used analysis of causality is the Granger definition of causality. This analysis is based on Granger (1969) and Sims (1972). The Granger causality test assumes that the relevant information for the prediction of the variables is found only in the time-series data. The analysis examines the possibility of the current value of a variable  $Y$  being explained by the past values of another variable  $Z$ , over and above the explanations provided by past changes in  $Y$ . It also helps to establish whether adding lagged values of the variable can improve the explanation. Otherwise, the conclusion will be that  $Z$  does not Granger cause  $Y$ . The same analysis can be done the other way around. The test between FDI and exchange rate undertaken in this paper involves estimating the following bivariate linear regressions:

$$FDI_t = \lambda_0 + \sum_{i=1}^m \lambda_i FDI_{t-i} + \sum_{j=1}^m \partial_j RER_{t-j} + U_t \quad (1)$$

$$RER_t = \lambda_0 + \sum_{i=1}^m \lambda_i RER_{t-i} + \sum_{j=1}^m \partial_j FDI_{t-j} + \varepsilon_t \quad (2)$$

Equation (1) postulates that current FDI is related to its own past values as well as those of real exchange rate. On the other hand, equation (2) posits

that the current value of real exchange rate is related to its own past values and those of FDI. In this analysis, four possible outcomes can be identified. The first is unidirectional causality running from FDI to real exchange rate. The second another unidirectional causality, but running from real exchange rate to FDI. The third possibility is bidirectional or feedback or bilateral causality between FDI and real exchange rate. This is a case where the set of coefficients of FDI and real exchange rate are both statistically and significantly different from zero in the two equations. The fourth outcome is statistical independence, that is, neither causes the other. In this case, both FDI and real exchange rate coefficients are not statistically significant.

The theoretical and empirical inconclusiveness on the relationship between real exchange rate and FDI calls for this kind of methodology that takes cognizance of possible interdependence between the variables. To do this, we employ the vector autoregressive (VAR) methodology. This methodology is commonly employed for forecasting systems of interrelated time series. It sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of their lagged values. Assuming that the VAR contains two lagged values of the endogenous variables, it may be mathematically written as:

$$\begin{aligned}
 FDI_t &= \alpha_{11} FDI_{t-1} + \alpha_{12} RER_{t-1} + \beta_{11} FDI_{t-2} + \beta_{12} RER_{t-2} + c_1 + \varepsilon_{1t} \\
 RER_t &= \alpha_{22} FDI_{t-1} + \alpha_{22} RER_{t-1} + \beta_{21} FDI_{t-2} + \beta_{22} RER_{t-2} + c_2 + \varepsilon_{2t} \quad (3)
 \end{aligned}$$

Here,  $\alpha_{ij}$ ,  $\beta_{ij}$  and  $c_i$  are the parameters to be estimated.

The third method employed in investigating the FDI-real exchange rate nexus is the simultaneous technique, whereby both variables are jointly determined. This specification follows Kosteletou and Liargovas (2000).

For our purpose, the following system of equations is estimated:

$$\begin{aligned}
 \Delta \log REER_t &= \left( \begin{array}{cccc} (?) & (+) & (-) & (+) & (+) \\ \Delta \log(FDI_t), \pi_t, \pi_t^*, i_t, i_t^* \end{array} \right) \\
 \Delta \log FDI_t &= \left( \begin{array}{cccc} (?) & (+) & (+) & (-) \\ \Delta \log(REER_t), \Delta \log(Y) \Delta \log(Y_t^*), \Delta \log(R_t) \end{array} \right) \quad (4)
 \end{aligned}$$

REER is the real exchange rate represented by the real effective exchange rate in the respective countries, FDI is the foreign direct investment measured in real terms as a percentage of GDP,  $\pi$  symbolizes inflation rate,  $i$  represents nominal interest rate,  $i - i^*$  stands for interest rate differential between the domestic and the foreign country,  $Y$  represents income and  $R$  is the real interest rate. It should be noted that the variables with \* at the superscript are for foreign countries, while  $t$  at the subscript denotes the current period.

#### IV. Empirical Results

To examine the relationship between FDI and real exchange rate, we apply three econometric techniques. The selection of variables and lag length were based on diagnostic tests for autocorrelation and the Schwarz and Akaike information criteria. As a prelude to the analysis, the time series properties of the variables are investigated.

##### IV.1. Unit Root Tests

All the time series data of our variables of interest are tested in order to determine their time series properties. To ensure robustness of the enquiry, both the parametric approach [based on the Augmented Dickey-Fuller (ADF) test, proposed by Dickey and Fuller (1979, 1981)] and the semi-parametric Philips-Perron test [based on Philips and Perron (1988)] were used. The test results presented in table 2 in the appendix indicate that the logarithm of both FDI and REER are nonstationary at levels. However, the first differences of all of both series are stationary. Thus, the variables are integrated of order one, that is, I(1).

##### IV.2. Vector Autoregressive Tests (VAR)

The first estimation technique is the VAR method, given the theoretical postulations on the relationship between FDI and real exchange rate changes. The VAR results show that the relationship between FDI and real exchange rate is inconclusive in the countries examined (see table 3 in the appendix). The effect of real exchange rate movements on FDI is found to be unambiguously negative only in the cases of Botswana, the Central African Republic, Ghana and South Africa. This implies that an appreciation in the domestic currencies of these countries will unambiguously lead to a de-

cline in FDI inflows. Similarly, it is only in the cases of Kenya and Uganda that real exchange rate has unambiguous positive effects on FDI, suggesting that currency appreciation rather improves FDI inflows in these countries. In all other cases, the effect of real exchange rate on FDI is either positive in the first lag and negative in the second, or vice versa. In all these results, statistically significant effects are observed in the second lag for Cameroon and Nigeria only.

Turning to the results on the effects of FDI on real exchange rate, we found results similar to the analysis above. In the cases of Botswana, the Central African Republic and Uganda, FDI seems to have unambiguous negative sign, while unambiguous positive sign is observed in Cameroon and Kenya. For the remaining countries, the effect of FDI on real exchange rate is either positive in the first lag and negative in the second, or vice versa. In all of the models, it is only in the cases of Cameroon and Ghana that significant effects are recorded at the second and first lag, respectively. These findings seem to confirm the theoretical postulation and earlier empirical findings that the relationship between real exchange rate and FDI varies across countries, regions and sectors.

### *IV.3. Direction of Causality*

The causality between changes in FDI and REER has not drawn much attention in the literature. There appears to be an implicit assumption that causality runs from exchange rate to FDI. In what follows, we provide a formal analysis of the direction of causality between FDI and REER in the selected SSA countries. The causality applied here is the Granger causality test based on Granger (1969), and is as earlier defined. However, the caveat as expressed in Harvey (1990) is that causality is too strong a word, and thus Granger causality should be limited to the narrow concept of sequentiality and predictability.

The results of the pair-wise Granger causality tests for the changes in FDI and real exchange rate are presented in table 4 in the appendix. The Granger causality test results show that it is only in the cases of Cameroon and Ghana that causality is established, and while this relationship is bidirectional for Cameroon, causality rather runs one-way from FDI to real exchange rate in Ghana, and not the other way around. In all other cases, there is statistical independence between real exchange rate and FDI. These results seem to corroborate the VAR results that there exists some uncertainty about the relationship between real exchange rate and FDI flows in SSA.

In Cameroon, changes in FDI lead to changes in real exchange rate, but changes in real exchange rate also induce changes in FDI. This suggests that in the case of real exchange rate depreciation due to movements in any of the exchange rate fundamentals, foreign investors will tend to increase their investment in the economy. The logic behind this action is that exchange rate depreciation leads to a reduction in the domestic economy *vis-à-vis* foreign countries. Thus, investors in their bid to take advantage of the reduced cost of production in the economy tend to intensify investment in the country experiencing currency depreciation. The large FDI inflows induced by currency depreciation, if unchecked and depending on where such capital goes, may lead to undesirable consequences such as the Dutch Disease. The Dutch Disease is the consequence of the appreciation in real exchange rate resulting from large capital inflows that may ultimately lead to a shift in the production structure from tradables to non-tradables. In an effort to prevent such undesirable occurrence, policymakers should attempt to reduce the pressure on domestic currency depreciation by tightening the money supply through raising the domestic interest rate. Alternatively, such foreign capital can be used to shore up foreign reserves that may be ultimately used to intervene in the foreign exchange market with the aim of stabilizing the domestic currency. This demonstrates the possible channel for the observed bidirectional relationship between FDI and real exchange rate in Cameroon.

In Ghana, where the causality runs from changes in FDI to real exchange rate changes, one possible cause of the large FDI inflows into the country is the relative macroeconomic stability the country has experienced over a long period of time, coupled with the monetary authority's inability to manage the exchange rate effectively. However, in recent times, where the Central Bank is more independent in pursuing monetary policy, there appears to be a change, as the exchange rate has been better controlled. In addition, the currency revaluation that was carried out in 2007 has further strengthened the exchange rate and reduced currency fluctuations.

#### *IV.4. System Estimation*

Our next line of investigation involves specifying and estimating a system of two models, where the relationship between real exchange rate and FDI are simultaneously examined for the selected countries using the

two-stage-least-squares methodology.<sup>4</sup> The models are specified in a log-linear differenced form. The model is appropriately instrumented to ensure validity of the results obtained. The results are presented in tables 5 and 6 in the appendix.

The perverse signs of the estimated coefficients for the price indexes, interest rates and real output in some of the countries are obvious. This is not unconnected with the peculiarities of each economy. For instance, in large economies like Nigeria and South Africa, where a reasonable percentage of FDI is aimed at production for the domestic market, market size (represented by domestic GDP) has a statistically significant positive effect on FDI inflows. This contrasts sharply with a small economy like Botswana, where a greater percentage of FDI inflows are meant for exports. In this case, foreign GDP has a stronger impact on FDI inflows.

The estimated coefficients for the effects of FDI on real exchange rate are statistically significant at the 1 per cent level for Uganda, and at the 10 per cent level for Botswana, Nigeria and South Africa. The corresponding coefficients for all other countries are not significantly different from zero. One important finding emanating from this is that for FDI to significantly induce changes in exchange rate, such FDI inflows must be consistently high. This explains why it is countries like Botswana, Nigeria and South Africa, with very significant FDI inflows, that this could be established.

The effect of real exchange rate on FDI is statistically significant at the 10 percent level or better for Botswana at the first lag, Cameroon for both the level and the first lag, and Nigeria and South Africa at the first lag. While the magnitudes of the estimated coefficients differ across countries, one important finding discernible from this result is that real exchange rate influences FDI inflows with a lag. It also appears that the effects of real exchange rate on FDI are more pronounced for countries with a floating exchange rate system *vis-à-vis* countries with currency pegging. However, major currency devaluation and volatile macroeconomic factors might explain the statistically significant positive effect of real exchange rate movements on FDI in Cameroon.

Generally, the estimated negative effect of FDI on real exchange rate appears to provide a modest support for the monetary approach to real

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<sup>4</sup> The recurring problem of singular matrix precludes us from conducting a cointegration analysis. In any case, our focus in the study is the short run.



exchange rate determination. It also seems to corroborate the trade integrated model. An exogenous rise in capital inflows in most SSA countries induced expenditure in domestic consumption for both traded and non-traded goods, thus causing appreciation in their real exchange rates. The findings on the relationship between real exchange rates and FDI imply that exchange rate policies could be a potent tool for influencing FDI, while at the same time FDI policies would serve as effective tools for influencing real exchange rates in SSA.

## V. Conclusion

This paper explored the relationship between real exchange rate and FDI for selected SSA countries. Both globalization of financial markets and capital account liberalization by most SSA countries present challenges for exchange rate movements and financial flows, especially FDI. The findings of this paper have shown that there exists a relationship between real exchange rate and FDI in SSA. While the study could not establish a clear-cut relationship in terms of direction of causality for most of the countries, the regression estimates do reveal a pattern of relationship. The effects of FDI on exchange rate changes are found to be significant in Nigeria, South Africa and Botswana. A resonating finding emanating from this is that for FDI to significantly induce changes in exchange rate, such FDI inflows must be consistently high, as demonstrated in these countries for the most part of the period investigated. On the other hand, statistically significant effects of real exchange rate on FDI are established for Botswana, Cameroon, Nigeria and South Africa, though with varying magnitudes. The resounding finding here is that, in many cases, real exchange rate influences FDI inflows with a lag. There is also a tendency that the effects of real exchange rate on FDI are more pronounced for countries with a floating exchange rate system *vis-à-vis* those with currency pegging. Generally, the empirical models suggest a negative relationship between real exchange rate and FDI, thus suggesting that real exchange rate management is crucial for attracting FDI in SSA. Thus, monetary authorities should fashion and implement effective exchange rate management policies in SSA countries. There is also need for policy coordination between monetary and fiscal authorities to ensure that fiscal policy does not undermine the efforts of monetary authorities at managing exchange rate effectively.

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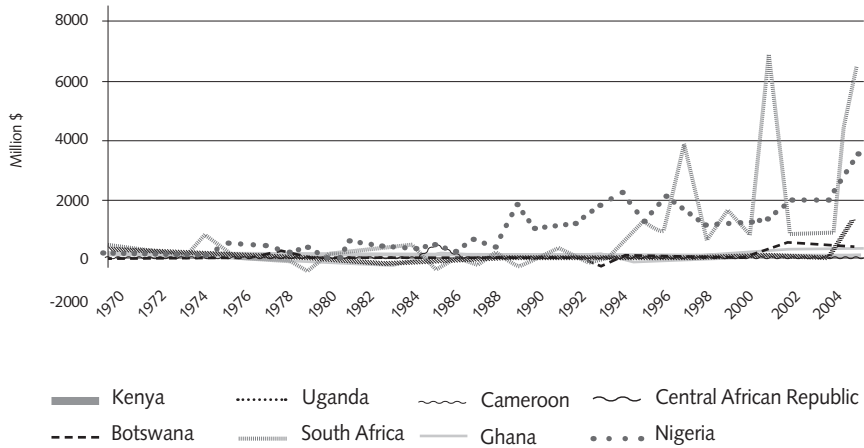
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## Appendix

**Figure 1.** Pattern of FDI inflows to the selected SSA countries, 1970-2005



Source: UNCTAD FDI database, accessed on January 17<sup>th</sup>, 2009.

**Table 1.** FDI inflows in selected sub-Sahara African countries (\$ Million)

<i>Year/country</i>	<i>Botswana</i>	<i>Cameroon</i>	<i>Central African Republic</i>	<i>Ghana</i>	<i>Kenya</i>	<i>Nigeria</i>	<i>South Africa</i>	<i>Uganda</i>
1970-1979	25.66	20.06	4.43	21.73	30.67	319.62	92.22	0.69
1980-1989	62.67	95.62	5.04	8.72	30.42	433.99	14.16	0.99
1990-1999	15.89	28.46	0.88	113.47	20.96	1 494.06	850.32	71.97
1970-2007	103.19	99.88	5.37	95.64	49.79	1 652.39	846.26	87.70
2000	57.32	158.80	0.84	165.90	110.91	1 309.66	887.92	180.81
2001	30.84	73.29	5.18	89.30	5.30	1 277.42	6 788.72	151.50
2002	404.62	601.75	4.30	58.90	27.63	2 040.18	1 572.77	184.65
2003	419.5	383.00	12.90	105.40	81.74	2 171.39	733.67	202.19
2004	391.55	319.34	15.11	139.27	46.06	2 127.09	799.23	295.42
2005	281.32	224.66	17.11	144.97	21.28	4 978.26	6 643.78	379.81
2006	488.80	308.99	18.11	636.00	50.73	13 956.49	-527.10	400.25
2007	494.90	284.33	27.21	855.40	728.01	12 453.74	5 692.07	367.90

*Source:* UNCTAD FDI database, accessed on January 17<sup>th</sup>, 2009.

**Table 2.** The unit root test results for selected variables

Country	Variable	ADF		Phillips-Perron		Conclusion
		Level	First difference	Level	First difference	
Botswana	FDI	-1.762	-11.307	-4.757	-23.417	I(1)
	REER	-2.081	-6.822	-2.081	-7.151	I(1)
Cameroon	FDI	-1.028	-6.001	-1.019	-6.009	I(1)
	REER	-2.364	-7.066	-2.381	-7.066	I(1)
CAR	FDI	-1.578	-6.093	-1.398	-6.234	I(1)
	REER	0.409	-10.410	0.489	-10.436	I(1)
Ghana	FDI	1.652	-3.999	-2.482	-5.490	I(1)
	REER	-2.292	-10.735	-2.492	-8.471	I(1)
Kenya	FDI	-1.768	-10.060	-1.466	-12.374	I(1)
	REER	-1.101	-6.230	-1.217	-6.356	I(1)
Nigeria	FDI	-2.482	-5.490	-2.437	-5.490	I(1)
	REER	-0.016	9.289	-0.479	-9.431	I(1)
South Africa	FDI	-2.749	-6.799	-2.459	-6.864	I(1)
	REER	0.228	-11.979	-3.729	-13.448	I(1)
Uganda	FDI	-0.390	-6.507	-1.238	-6.591	I(1)
	REER	1.051	-6.656	-0.065	-11.242	I(1)

Source: Authors' own computation. Note: The critical values are -3.64, -2.95 and -2.61 at the 1%, 5% and 10% levels, respectively.

**Table 3.** VAR Estimation results

	Botswana		Cameroon		Central African Republic		Ghana	
	FDI	RER	FDI	RER	FDI	RER	FDI	RER
FDI(-1)	-0.0018 [-0.0092]	-0.2753 [-1.6582]	0.0239 [0.0636]	0.1517 [0.9512]	-0.0635 [-0.2779]	-0.05808 [-0.2546]	0.0165 [0.0707]	0.3249* [2.3213]
FDI(-2)	-0.5129* [-2.4224]	-0.0259 [-0.1467]	0.6685 [1.8557]	0.5576*** [3.6474]	-0.0181 [-0.0785]	-0.0261 [-0.1136]	-0.1958 [-0.8034]	-0.0235 [-0.1605]
RER(-1)	-0.2279 [-0.8477]	-0.0166 [-0.07367]	0.2509 [0.3765]	-0.2585 [-0.9142]	-0.0864 [-0.3768]	-0.0995 [-0.4348]	-0.1450 [-0.4053]	0.2269 [1.0551]
RER(-2)	-0.1602 [-0.6361]	0.1526 [0.7248]	-1.4556* [-2.1478]	-0.8875*** [-3.0858]	-0.0659 [-0.2869]	-0.0789 [-0.3444]	-0.1163 [-0.3581]	0.0851 [0.4361]
R-squared	0.2567	0.1486	0.2322	0.4160	0.0147	0.0183	0.0869	0.3102
F-statistic	1.6400	0.8289	1.4367	3.3840	0.0711	0.0883	0.4524	2.1356

Source: Authors' own computation. \*\*\*, \*\*, and \* imply statistical significance at the 1%, 5%, and 10% levels, respectively.



**Table 3.** VAR Estimation results (continuation)

	Kenya		Nigeria		South Africa		Uganda	
	FDI	REER	FDI	REER	FDI	REER	FDI	REER
FDI(-1)	-0.6659** [-3.3421]	0.0134 [0.1913]	-0.0227 [-0.3276]	0.2203 [0.6629]	-0.0121 [-0.1002]	-0.0008 [-0.0024]	-0.4326 [-0.9372]	-0.1754 [-1.0094]
FDI(-2)	-0.4265* [-2.1391]	0.0529 [0.7535]	0.0165 [0.2381]	-0.0211 [-0.0634]	0.0566 [0.4688]	0.4171 [1.2583]	-0.4688 [-1.0548]	-0.0962 [-0.5751]
RER(-1)	0.5105 [0.8357]	-0.4535* [-2.1048]	0.0553 [1.1282]	-0.0159 [-0.0678]	-0.0975 [-1.2349]	-0.1274 [-0.5878]	0.9759 [0.7908]	0.5352 [1.1525]
RER(-2)	0.8691 [1.4156]	-0.2859 [-1.3203]	-0.0949* [-1.9094]	-0.1457 [-0.6109]	-0.0358 [-0.4528]	-0.3404 [-1.5681]	1.2745 [1.0881]	0.4452 [1.0100]
R-squared	0.3992	0.2231	0.2399	0.03799	0.0968	0.1506	0.1304	0.2008
F-statistic	3.1564	1.3635	1.4995	0.1876	0.5092	0.8424	0.7123	1.1931

Source: Authors' own computation. \*\*\*, \*\* and \* imply statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 4.** Bivariate Granger causality results

<i>Country</i>	<i>Null hypothesis</i>	<i>F-statistic</i>	<i>Probability</i>
Botswana	FDI $\neq$ REER	1.39093	0.27306
	REER $\neq$ FDI	0.55189	0.58482
Cameroon	FDI $\neq$ REER	2.83701	0.08354*
	REER $\neq$ FDI	6.67105	0.00639***
CAR	FDI $\neq$ REER	0.10337	0.90230
	REER $\neq$ FDI	0.03740	0.96336
Ghana	FDI $\neq$ REER	0.24273	0.78688
	REER $\neq$ FDI	2.74392	0.08977*
Kenya	FDI $\neq$ REER	1.06072	0.36583
	REER $\neq$ FDI	0.29908	0.74493
Nigeria	FDI $\neq$ REER	2.55939	0.10370
	REER $\neq$ FDI	0.22094	0.80379
South Africa	FDI $\neq$ REER	0.83208	0.45039
	REER $\neq$ FDI	0.79227	0.46722
Uganda	FDI $\neq$ REER	1.40982	0.26860
	REER $\neq$ FDI	0.73521	0.49256

*Source:* Authors' own computation. *Notes:*  $\neq$  implies does not Granger cause. \*\*\* and \* denote existence of Granger causality at the 1%, and 10% level, respectively.

**Table 5.** Relationship between real exchange rate changes and FDI in SSA

Equation (1): Dependent variable is  $\Delta \log(\text{REER}_t)$

Country	$\Delta \log(\text{REER}_{t-1})$	$\Delta \log(\text{FDI}_t)$	$\pi$	$\pi^*$	$i$	$i-i^*$	$R^2$	LM(1)	LM(2)
Botswana	-0.5236*** (-5.7725)	-0.1806** (-2.5993)	0.7672*** (7.49530)	0.0641 (0.7219)	0.2054 (1.5507)	0.0150 (0.0471)	0.8286	0.11 (0.75)	0.26 (0.77)
Cameroon	-0.4115*** (-4.9349)	-0.1332 (-1.8595)	0.2215*** (6.0640)	-0.1651** (-3.4415)	-0.0467 (-1.1174)	-0.1407* (2.0952)	0.9192	0.01 (0.94)	0.02 (0.98)
CAR	-0.2897 (-1.3476)	0.08267 (0.4634)	-0.02456 (-0.2369)	0.1107 (0.6389)	0.0256 (0.1487)	0.9754** (2.5935)	0.4916	0.02 (0.89)	2.06 (0.16)
Ghana	0.0127 (0.0494)	0.1374 (0.7729)	-0.1479 (1.0049)	0.2682* (1.9809)	0.0966 (0.9880)	-0.0378 (-0.1123)	0.4659	0.90 (0.36)	0.50 (0.62)
Kenya	-0.8217*** (-3.9462)	0.0763 (1.3632)	0.1759 (1.3681)	-0.2258* (-1.9289)	0.1232 (1.1276)	-0.3574 (-1.5771)	0.6772	1.17 (0.29)	5.05 (0.02)
Nigeria	-0.2627 (-0.9531)	-1.6956** (-2.1233)	0.2196 (0.6627)	-0.5894** (-2.4465)	-0.9928 (-1.2269)	-0.2581 (-0.8198)	0.5329	0.19 (0.67)	1.79 (0.21)
South Africa	-0.3277** (-2.4578)	-0.4976** (-2.5586)	-0.3565 (-1.3754)	-0.1006 (-0.5333)	1.3387*** (4.4297)	-0.9797 (-1.4522)	0.6569	0.03 (0.86)	0.65 (0.54)
Uganda	-0.2991 (-1.2349)	-0.2864*** (-7.3517)	-0.0019 (-0.0278)	0.0261 (0.4774)	0.0491 (0.9103)	0.0187 (0.3032)	0.7820	1.57 (0.22)	0.75 (0.49)

Source: Author's own computation. Notes: The values in brackets are the  $t$ -statistic; \*\*\*, \*\*, \* and \* imply statistical significance at the 1%, 5%, and 10% levels, respectively. LM is the Lagrange multiplier for first or fourth order autocorrelation.

**Table 6.** Relationship between real exchange rate changes and FDI in SSA

Country	$\Delta \log$ ( <i>REER</i> <sub><i>t</i></sub> )	$\Delta \log$ ( <i>REER</i> <sub><i>t-1</i></sub> )	$\Delta \log$ ( <i>FDI</i> <sub><i>t-1</i></sub> )	$\Delta \log$ ( <i>GDP</i> <sub><i>t</i></sub> )	$\Delta \log$ ( <i>GDP</i> <sub><i>t-1</i></sub> )	$\Delta \log$ ( <i>GDP</i> <sub><i>t</i></sub> )	$\Delta \log$ ( <i>RINTRT</i> <sub><i>t</i></sub> )	<i>R</i> <sup>2</sup>	<i>LM</i> (1)	<i>LM</i> (2)
Botswana	0.3203 (1.2549)	-0.5236*** (-5.7725)	-0.9621*** (-4.6408)	-0.2239 (-0.2709)	-0.3445* (-1.9253)	-2.1016** (-2.9246)	0.5138	5.85 (0.02)	3.46 (0.06)	
Cameroon	1.4228*** (4.3043)	1.6871** (3.0915)	-1.0261** (-3.4374)	0.4841 (0.8588)	-0.1634 (-0.5931)	0.5634* (1.9322)	0.6446	0.45 (0.51)	0.31 (0.74)	
CAR	-0.3141 (-0.9926)	-0.2487** (-2.8410)	-0.7930** (-3.0832)	-0.1488 (-0.4327)	0.1774 (0.4832)	0.0739 (0.4217)	0.4352	0.11 (0.75)	0.16 (0.86)	
Ghana	0.1349 (0.2992)	-0.3838 (-0.9808)	-0.1279 (-0.4714)	1.5857 (1.1312)	-0.7269* (-2.1443)	0.0857 (0.5771)	0.3779	0.78 (0.39)	5.29 (0.02)	
Kenya	-0.0481 (0.0818)	—	-0.9696*** (-4.1089)	0.4597 (0.6431)	0.5348 (0.7837)	-0.1474 (-0.3528)	0.5488	8.82 (0.01)	7.53 (0.01)	
Nigeria	0.0274 (0.3041)	0.0961** (2.9684)	-0.5969** (-2.4822)	1.1043** (2.6299)	0.5381 (1.5294)	-0.0419 (-0.1769)	0.5625	0.02 (0.90)	0.83 (0.46)	
South Africa	0.2268 (1.3500)	0.0027* (2.0231)	-0.4274 (-1.7266)	0.4838** (2.9703)	-0.0445 (-0.1332)	-0.2189 (-0.6937)	0.5287	0.95 (0.34)	2.45 (0.12)	
Uganda	1.4801** (3.5493)	-0.1327 (-0.2365)	0.1303 (0.6299)	1.0287** (2.4623)	0.7122** (2.3859)	-0.0376 (-0.3179)	0.8885	0.04 (0.84)	0.09 (0.92)	

Source: Author's own computation. Notes: The values in brackets are the *t*-statistic; \*\*\*, \*\*, and \* imply statistical significance at the 1%, 5%, and 10% levels, respectively. LM is the Lagrange multiplier for first or fourth order autocorrelation.