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Emmanuel Ekow Asmah  
*University of Cape Coast, Ghana*

Francis Kwaw Andoh  
*University of Cape Coast, Ghana*

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Exchange Rate Volatility and Foreign Direct Investment in Sub-Saharan Africa

Emmanuel Ekow Asmah and Francis Kwaw Andoh
University of Cape Coast, Ghana

ABSTRACT

Foreign Direct Investment (FDI) is an important source of financing development. It enhances efficiency and raises skills of local manpower, facilitates transfer of technology, generates employment and promotes productivity resulting in broad welfare improvements. Although FDI could have a substantial impact on the growth of African economies, poverty reduction and the achievement of various dimensions of human development as articulated in the Millennium Development Goals, its flows to Africa, though growing steadily have been relatively low, volatile, and highly concentrated in a few countries. One of the factors that have been identified in the literature as key drivers of FDI is exchange rate volatility; yet, the evidence on the impact of exchange rate volatility on FDI has been mixed and few of such studies focus on Africa. Using a dynamic linear panel model applied to data from 27 African countries, this study examines exchange rate volatility on FDI flows to Africa. The study finds a robust negative and significant impact of exchange rate volatility on FDI in African countries. Greater stability in the exchange rate system may be desirable in order to promote higher volumes of foreign direct investment inflows in African countries.

1 INTRODUCTION

Evidence shows that, with suitable host-country investment climate and policies, foreign direct investments (FDI) have the potential to play a significant role in economic development, especially in developing countries. FDI provides a major source of capital which brings with it up-to-date technology and offers the prospects of a greater diversification of the industrial base and exports which contribute to the integration of economies to the rest of the world. Over time, FDI associates with many positive externalities in the form of employment generation, skills transfer, technological progress, and enhanced productivity and efficiency. Ultimately, these factors have a positive impact on economic growth and consequential poverty reduction. Given the benefits of FDI inflows, attracting FDI has become an important policy objective of many countries. Recent empirical evidence suggests that a sustained rate of economic growth of between 8 and 10 percent is necessary for Africa to reverse the spread of poverty to meet the millennium development goals in 2015. In this respect, an increase in FDI is deemed necessary to close the development financing gap characteristic of Sub-Saharan Africa which generally attract a very small share of FDI inflows relative to other developing regions (Asiedu, 2005).

Apart from traditional economic factors such as host country’s macroeconomic policies, legal system, political stability, and market size availability of raw materials, foreign exchange
volatility has also emerged as critical in attracting FDIs. However, the empirical evidence of the relationship between exchange rate volatility and FDI flows has not been clear cut (Kosteletou and Liargovas, 2000). While some studies have found FDI to be negatively correlated to appreciation of the domestic currency and to measures of exchange rate volatility (see for example, Campa, 1993; Goldberg, 1993; Darby et al., 1999; Bennasy-Quere et al., 2001; Serven, 2003; Byrne and Davis, 2005 and Lizardo, 2009) others have found a positive relationship (see for example, Chowdhury and Wheeler, 2008; Cushman, 1985 and 1988; Goldberg and Kolstad, 1995 and Sung and Lapan, 2000). Other studies like Gorg and Wakelin (2002) even found negligible exchange rate volatility effects in a sample of United States FDI to 12 OECD countries.

Not only are the findings on the FDI-exchange rate volatility nexus inconclusive, but also the literature exploring the relationship is limited for Africa. What then can we say of the relationship between exchange rate volatility and the quantitative and directional flows of FDI in Africa? Are there specific foreign exchange issues that FDIs perceive as critical and important for the flow of foreign investment to Africa? Answers to these questions are important because they will provide a basis for evaluating current government exchange rate policies vis-à-vis their expected potential to attract FDI. This study therefore fills this gap by examining the impact of exchange rate volatility on the flows of FDI in Africa.

The rest of the paper is organized as follows. The next section provides an overview of the literature on the relationship between FDI and exchange rate volatility. In section 3, the model, data and methods adopted to estimate the relationships among the selected variables are presented. The results from the panel-data analysis are summarized in section 4, while the final section 5 provides brief conclusions and implications from the paper.

2 LITERATURE REVIEW

Aizenmann (1992) and Sung and Lapan (2000) have argued that the theoretical impact of exchange rate volatility on FDI is ambiguous. They explained that in general and at a first glance, high volatility in the exchange rate is likely or expected to discourage inflows because it increases uncertainty in business environment in the host country. But, it is possible that the uncertainty created by exchange rate volatility can give rise to the option of enhancing production flexibility by investing in several countries simultaneously and rotating production to whichever country provides the cheapest production platform. Goldberg (2009) in an exposition on the FDI-exchange rate nexus for the Princeton Encyclopedia of the World Economy broadly divides the arguments into two: (i) production flexibility arguments and (ii) risk aversion arguments. Since exchange rate movements affect expected profits, they influence the attractiveness of FDI. By the production flexibility arguments, more volatility is associated with more FDI ex-ante, and more potential for excess capacity and production shifting ex-post, after exchange rates are observed.
The logic underlying the risk aversion argument by Goldberg (2009) is that investors require compensation for risks that exchange rate movements introduced into the returns on investment. Higher exchange-rate variability lowers the certainty equivalent expected exchange-rate level Cushman (1985, 1988). If exchange rates are highly volatile, the expected values of investment projects are reduced, and FDI is reduced accordingly. All of these arguments provide different directional implications of exchange rate volatility on FDI, giving credence to the ambiguity found in the empirical literature. The study by Carruth et al. (2000) provides an extensive review of the empirical literature which confirms the ambiguous nature of the relationship between FDI and exchange rate volatility.

Bénassy-Quéré et al. (2001) investigated the impacts of exchange rate volatility, and found that high exchange rate volatility discouraged FDI. Similar findings were obtained by Ogunleye (2008) for nine countries in Sub-Saharan Africa, and Kiyota and Urata (2004) for Japan. The hypothesis that foreign direct investment into the United States responds to variations in exchange-rate levels and to exchange-rate uncertainty was tested by Amuedo-Dorantes and Pozo (2001) for the period 1976-1998. While a long-run relationship was found to exist among foreign direct investment inflows as a share of Gross National Product (GNP), no discernible link between the real exchange rate and inward foreign direct investment was found. The study also concluded that foreign direct investment decreases in response to increases in exchange-rate uncertainty in the short run when a conditional measure of exchange-rate uncertainty is used.

In examining the role of exchange rate volatility in the evolution of FDI inflows into EMU neighborhood countries, Furceri and Borelli (2008) found that the effect of exchange rate volatility on FDI crucially depends on a country's degree of openness. In fact, while exchange rate volatility has positive or null effect for relatively closed economies, it has a negative impact on economies with a high level of openness. This result is particularly relevant for transition economies and is robust to the use of different econometric specifications and measures of exchange rate volatility.

According to Husek and Pankova (2008), depreciation of the currency of the host country is likely to attract FDI inflows at least for two reasons. First, the currency depreciation reduces production costs (domestic labor and other productive inputs) relative to foreign production costs in the host country vis-à-vis other countries including the home country, thereby making it attractive for FDI seeking for production efficiency. Second, the currency depreciation lowers the value of assets in the depreciating host country in terms of other currencies including the currency of the home country. Accordingly, the cost of undertaking FDI declines in terms of foreign currency, making FDI in the depreciating country attractive.

The following discussion shows that the impact of exchange rate uncertainty on FDI is ambiguous from both theoretical and empirical points-of-view. Given that there is little evidence on the impact of exchange rate volatility on FDI flows in Africa this paper contributes to the debate with recent data for African economies.
3 MODEL, DATA AND ECONOMETRIC METHODOLOGY

The main thrust of this study is to establish whether exchange rate volatility matters for FDI inflows. Following from the literature review, the study assesses the relationship using a linear dynamic panel data regression analysis incorporating the main macroeconomic determinants of FDI based on the following reduced-form equation:

\[
FDI_{it} = \beta_0 + \beta_1 EXRVOL_{it} + \beta_2 FDI_{it-1} + \beta_3 GDP_{PCit} + \beta_4 OPENNESS_{it} + \beta_5 INTRATE + \\
\beta_6 EXRATE_{it} + \beta_7 POLINST_{it} + \eta_i + \varepsilon_{it} \tag{1}
\]

Where subscripts \(i\) and \(t\) denote country and time period, respectively. All the variables are expressed in their logarithms. The dependent variable is foreign direct investment \(FDI_{it}\) measured as the annual FDI inflows from all sources to the host economy, as a percentage of GDP. \(EXRVOL_{it}\) is the bilateral exchange rate volatility, the variable of interest in this study. \(FDI_{it-1}\), represents the stock of FDI in the previous period while \((GDP_{PCit})\) is the per capita gross domestic product, which is used as a proxy for the market size and as an indicator for the purchasing power of local consumers. Trade openness or the trade intensity index \((OPENNESS_{it})\), is measured as the sum of the shares of exports and imports in GDP, while \((EXRATE_{it})\) is the nominal exchange rate for each country, measured as annual averages of the domestic currency units per US dollar. Owing to the fact that countries engage with multiple international trade and investment partners, estimating with only the bilateral exchange rates as defined here may be inadequate. Consequently, the aggregate real effective exchange rates from weighted averages of bilateral exchange rates are also included. This measure allows for a better understanding of how other exchange rates influence FDI flows. \(INTRATE_{it}\) is the annual average interest rate in the host economy which captures the host country’s return on investment. Given that many countries in Africa are characterized by dictatorial regimes, poor governance, conflicts, etc. which all have the tendency to increase uncertainties and investment risks, an index of the quality of political institutions, \(POLINST_{it}\), is included to capture the political system in the country at time \(t\), whether democratic or authoritarian. The unobservable country-specific fixed effect for country \(i\) is represented by \(\beta_i\) while \(\varepsilon_{it}\) is the disturbance term. Exchange rate volatility is generated using the Generalised Autoregressive Conditional Heteroskedasticity (GARCH) methodology explained subsequently.

The observation period for the study is from 1975 to 2011, and covers 27 sub-Saharan African countries operating flexible exchange rate systems for most of the period. The countries involved in the study include: Benin, Burkina Faso, Burundi, and Central Africa Republic, Chad, Comoros, Democratic Republic of Congo, Eritrea, Ethiopia, The Gambia, Guinea, Guinea Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Rwanda, Sierra Leone, Somalia, Tanzania, Togo, Uganda and Zimbabwe. The data for the study is from various publications of World Development Indicators (WDI) and International Financial Statistics (IFS) tables.
4 ESTIMATING EXCHANGE RATE VOLATILITY

The study uses the Autoregressive conditional heteroscedasticity (ARCH) introduced by Engel (1982), later modified to Bollerslev’s (1986) Generalized Autoregressive Conditional Heteroscedasticity (GARCH), to generate the exchange rate volatility. The strength of this approach lies in its ability to capture risk in each period more sensitively than simple standard deviations, which give equal weight to correlated shocks and single large outliers. The GARCH requires that for each country in our sample we run a regression of the following type:

\[ \ln Y_t = a_0 + a_1 \ln Y_{t-1} + \epsilon_t \]

Where \( \epsilon_t \sim N(0, h_t) \)

The variance equation can be written as:

\[ h_t = \varphi + \alpha \epsilon_{t-1}^2 + \gamma h_{t-1} + \mu_t \]

The conditional variance \( (h_t) \) in equation described above is a function of three terms:

The mean \( (\varphi) \)

Information about volatility from the previous period, measured as the lag of the squared residual from the mean equation \( (\epsilon_{t-1}^2) \); the ARCH term

The last period’s forecast error variance, \( \gamma h_{t-1} \); the GARCH term.

In this study, we estimate a multivariate GARCH model to obtain the conditional variances of the real dollar exchange rates and the multilateral real effective exchange rates. These estimates are then used as instruments in the panel estimation of the determinants of FDI.

5 ESTIMATION TECHNIQUE

The study employs the generalized method of moments (GMM) estimator of Arellano and Bond (1991) for estimating panel data. Linear dynamic panel-data models include lags of the dependent variable as covariates and contain unobserved fixed or random panel-level effects. By construction, the unobserved panel-level effects are correlated with lagged dependent variables, making standard estimators inconsistent. The Arellano and Bond (1991) estimator removes the country/individual specific effects through first-differencing and then employs a modified instrumental variables approach. The technique, also commonly known as the first-differenced GMM estimator, requires the validity of crucial assumptions associated with panel data, including group-wise heteroscedasticity, serial correlation, and multi-collinearity. In order to confirm that the Arellano and Bond (1991) GMM estimator provides satisfactory results, two critical tests are important. First, the Hansen (Sargan) test for over identifying restrictions is a
standard that proves the orthogonality conditions for instruments involved in the GMM estimation. Failure to reject the null hypothesis indicates that the instruments are valid, thus supporting the validity of the model specification. Second, the sample needs to be tested for the presence or absence of first- and second-order autocorrelation. By virtue of its construction, the Arelleno and Bond (1991) post-estimation orthogonality conditions are established under the assumption that the error term in the levels equation is not auto-correlated. Thus, the purpose of the Arellano-Bond autocorrelation test is to confirm this assumption. If the error term in the levels equation is not auto-correlated, then the error term in the first-difference equation has negative first-order autocorrelation, and zero second order autocorrelation. Once the hypothesis that there is zero second-order autocorrelation in the residuals of the first-difference equation is rejected, then the hypothesis that the error term in the levels equation is not auto-correlated is also rejected. This indicates that the orthogonality conditions are not valid - no matter which lags you use as instruments. The advantages of the Arellano and Bond (1991) and other GMM estimators include the fact that they exploit time-series variation in the data and account for the unobserved country specific effects. They allow for the inclusion of lagged dependent variables as regressors and, most important of all, control for the endogeneity of all the explanatory variables, hence yielding consistent and efficient estimates.

6 EMPIRICAL RESULTS

The estimated results from employing the Arellano and Bond (1991) linear dynamic panel-data estimator are presented in Table 1. The joint explanatory power of the model as measured by the Wald Statistic is 129.71 and has a significant P value, reflecting a rejection of the null hypothesis that all the right hand side variables except the constant have zero parameter coefficients. Past movements in the FDI as measured by the first lag of FDI is found to have highly significant and positive effects on FDI with a coefficient of 0.326.

**Table 1: System Dynamic Panel-Data Estimation (One-step results)**

| Variable     | Coefficient | Robust Std Error | z    | P > |z|  | 95% Conf. Interval |
|--------------|-------------|------------------|------|-----|---|------------------|
| LogFDILag_1  | 0.3255037   | 0.0809919        | 4.02 | 0.000 |     | 0.1667625 - 0.484245 |
| Log GDP_PC   | 1.519068    | 0.9295482        | 1.63 | 0.102 |    | -0.3028127 - 3.340949 |
| Log EXRATE   | 0.3310545   | 0.167993         | 1.97 | 0.049 |    | 0.0017943 - 0.6603146 |
| Log INTRATE  | 0.0906536   | 0.0380484        | 2.38 | 0.017 |    | 0.0160801 - 0.1652271 |
| Log OPENNESS | 0.0643667   | 0.0110973        | 5.80 | 0.000 |    | 0.0426163 - 0.086117 |
| EXRVOL       | -0.468697   | 0.0814318        | -5.76 | 0.000 |    | -0.6283003 - -0.3090936 |
| POLINST      | 0.081589    | 0.0361747        | 2.26 | 0.024 |    | 0.0106878 - 0.1524901 |
The variable used to capture bilateral exchange rate volatility in the model (the variable of interest for this study) EXRVOL, is negatively signed and statistically significant with an elasticity coefficient of 0.47. This finding lends support to previous findings of Serven (2003), Byrne and Davis (2005), and Lizardo (2009) which suggest that exchange rate uncertainty has a negative effect on FDI. In other words, a more volatile exchange rate, as captured by the conditional GARCH bilateral exchange rate measure of volatility, appears to be followed by reductions in foreign direct investment. The results suggest that the variability of the exchange rate introduces additional risk in multinational cash flows leading to reduced FDI.

The results also show that Exchange rates (EXRATE) are significant and positive indicating that an increase in the exchange rate leads to an increase in FDI. Since a rise in the exchange rate corresponds to a depreciation of the local currency, the study seems to suggest that a 1% devaluation of the host currency leads to a 0.33% increase in FDI. The basic argument is that real depreciations raise the relative price of foreign productive resources or increase the relative competitiveness of foreign competitors bidding for the same production site, which leads to a reduction in demand for physical investment abroad. The results from this study support this assertion. This result matches previous studies like Lizardo (2009) and Becker and Hall (2009) which found exchange rate depreciations increase flows of FDI.

Market size (proxied by per capita GDP) and Local rate of return (INTRATE) were also found to have positive impact on FDI inflows to Africa. This provides logical reason as to why countries with higher real GDP growth tend to consume more and are preferred by investors. The results also confirm the view by Jensen (2003) that a country’s political system is an important variable that influences FDI flows. The variable POLINST used to measure the political system in the country is positive and significant with a coefficient of 0.08. It is generally argued that good governance can offer the mechanism through which the political risks can be reduced. Stable democratic governance does not only prevent conflicts and ensure high levels of cooperation between states and firms, but also maintains a better stable policy environment toward multinational firms. Thus, investors count on the credibility of democratic nations to be a pull factor of FDIs. Higher inflation could be considered as a proxy for macroeconomic stability and could affect FDI both positively (risk premium) or negatively (lower macroeconomic stability). Unfortunately, the inflation variable was insignificant in the model and therefore, dropped from the estimation.
A striking, yet unsurprising, result found in this study is a confirmation that the FDI model is robust to the inclusion of a broader exchange rate measure. This is shown in Table 2 where real effective exchange rate measure is found to be significant but negative, contrasting with the earlier results in Table 1.

**Table 2: System Dynamic Panel-Data Estimation (One-step results)**

| Variable     | Coefficient | Robust Std Error | z   | P > |z| | 95% Conf. Interval |
|--------------|-------------|------------------|-----|-----|---|-------------------|
| Log FDI Lag_1 | 0.3567819   | 0.0858706        | 4.15| 0.000|   | 0.1884786 0.5250853 |
| Log GDP_PC   | 2.271633    | 1.115748         | 2.04| 0.042|   | 0.0848081 4.458458 |
| Log REER     | -0.3113044  | 0.1094294        | -2.84| 0.004|   | -0.525782 -0.0968268 |
| Log INTRATE  | 0.0905376   | 0.0341632        | 2.65| 0.008|   | 0.0235789 0.1574963 |
| Log OPENNESS | 0.001774    | 0.000893         | 1.99| 0.047|   | 2.29e-06 0.0003524 |
| REERVOL      | 0.017969    | 0.004019         | 4.47| 0.000|   | -0.019692 0.1416129 |
| POLINST      | 0.0698219   | 0.0366287        | 1.91| 0.057|   | 0.0010091 0.0025847 |

Number of Observations = 828  
Observations per group (min) = 6  
Observations per group (avg) = 19.25581  
Observations per group (max) = 27

Joint: $\chi^2(8)$ = 128.80  
Prob $>\chi^2$ = 0.0000

AR(1) test: N(0,1) = -4.638 (0.0000)  
AR(2) test : N(0,1) = 1.6391 (0.1012)

Therefore, an increase in the real effective exchange rate by 1% leads to a reduction in FDI inflows by 0.31. One possible causal channel for this kind of result may be associated with domestic efforts to mitigate some of the distributed and aggregated effects of a real appreciation. For example, an appreciation of the domestic currency may yield an increase in imports which, in turn, increases pressures for the implementation of protectionist policies. In this case, direct investment may take place in anticipation of future tariff barriers that are precipitated by adverse exchange rate movements. In a similar context, we find that the real effective exchange rate GARCH volatility measure when used is significant but positive, with a low coefficient of 0.02. This evidence supports the theory that the effect of volatility on FDI may in fact be positive when FDI is domestic-oriented. Fluctuations in the exchange rate are thus important but depend on the orientation of FDI in the African region. In all, the various econometric summary test statistics are in favor of the reported model. Since the AR (2) tests are not significant, the Arellano–Bond autocorrelation tests in the GMM models indicate that there are no problems relating to serial correlation in levels.
7 CONCLUSION

In this study, we have examined the dynamic relationships between FDI and its potential determinants. The paper estimates a GARCH model of the bilateral dollar exchange rate volatility, which is subsequently used in the panel estimation of the determinants of FDI based on the system GMM by Arellano and Bond (1991). The policy implications emanating from this study point to the need for governments that seek to attract foreign direct investment to pursue sound macroeconomic policies geared towards reducing overvaluation of the currency. Greater stability in the exchange rate system is desirable in order to promote higher volumes of foreign direct investment inflows in developing countries. An added benefit would require increased efforts towards liberalization of the economies. Our results also lend credence to existing theories that suggest that the choice of exchange rate measure is central to understanding FDI inflows.

It is worth noting that the extent to which FDI can be disaggregated will be an important issue that needs to be explored as an extension to this work. Clearly, different types of FDI may respond in different manners with respect to exchange rate volatility. Studies that focus on aggregate FDI flows, cannot distinguish between these variants of FDI. This represents a clear shortcoming if each type of FDI is most influenced by a different exchange rate measure. Furthermore, the interest rate variable is valuable to include in the model but may differ depending on the type of investment. Consequentially, different variants need to be considered in the future.

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