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Research Article

A Study of the Effect of Inflation and Exchange Rate on Stock Market Returns in Ghana

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The study examined the effect of exchange rate and inflation on stock market returns in Ghana using monthly inflation and exchange rate data obtained from the Bank of Ghana and monthly market returns computed from the GSE all-share index from January 2000 to December 2013. The autoregressive distributed lag (ARDL) cointegration technique and the error correction parametization of the ARDL model were used for examining this effect. The ARDL and its corresponding error correction model were used in establishing the long- and short-run relationship between the Ghana Stock Exchange (GSE) market returns, inflation, and exchange rate. The result of the study showed that there exists a significant long-run relationship between GSE market returns and inflation. However, no significant short-run relationship between them existed. The result also showed a significant long- and short-run relationship between GSE market returns and exchange rate. The variables were tested for long memory and it was observed that such property did exist in these variables, making it a desirable feature of which investors can take advantage of. This is due to the establishment of long-run effect of inflation and exchange rate on stock market returns.

1. Background

The creation of the Ghana Stock Exchange (GSE) was part of the recommendations of the economic reforms carried out in the 1980s to generate sustainable economic growth and development. Boateng [1] observes that, after many years of experiment with heavy state intervention in the economy, a consensus emerged that the achievement of a more dynamic economic growth required a greater role for the private sector and stock markets, since they are good levers for boosting private sector access to finance. This invariably means that the growth and sustainability of the stock market are of relevance to the government, institutions, and individual investors.

Most investors invest in stocks with the idea of maximizing the returns on their investment. However, these decisions are made without taking into account the effect that macroeconomic variables such as inflation and exchange rate can have on the stock prices of the listed companies [2]. Hussain et al. (2009) argued that stock markets have an essential role to play in the economy. According to them, stock markets serve as a source for the mobilization of domestic resources for productive investments. They further stated that to perform this role the stock market must have a significant relationship with the economy. Inflation, defined as the sustained, ongoing process of continuously rising level of general prices, is arguably a common concern to any government, since it serves as a proxy to determining how well its economy is doing. According to Ibrahim and Agbaje [3], inflation rate has been increasingly unsteady despite some stringent policies and efforts made by governments to control and fine-tune its values to a satisfactory stationary single-digit number. They also argued that factors such as income, high nominal wages, fluctuations in revenue, and the payment of debt can largely influence inflation in an economy. Over the years, changes in prices have been a visible characteristic of the Ghanaian economy, hence the nonconstant inflation rates.

According to Dritsakis [4], a long-run relationship exists between demand for money, inflation, real income, and exchange rate. He discovered that the elasticity of real income was positive, while that of inflation and exchange rate was negative. Tian and Ma [5] employed the cointegration ARDL approach to study the relationship between exchange rate and the Chinese share market. The result showed that exchange rate and money supply influence stock market positively. Qiao [6] established the relationship between the stock prices of Tokyo, Hong Kong, and Singapore and exchnage rate. These results showed the existence of a long-run relation between exchange rate and stock prices for all three markets. Özlen and Ergun [7] examined the relationship between stock returns and five macroeconomic variables using autoregressive distributed lag methodology. The result showed the existence of long-run relationships between the variables.

Tabak [8] conducted a study to analyze the dynamic relationship between exchange rate and stock prices in the Brazilian economy using Granger causality. The result showed no long-run relationship among the variables. Banny and Enlaw [9] analyzed the link between the Malaysian ringgit in relation to the US dollar and prices of stock in Kuala Lumpur Stock Exchange (KLSE). The study showed that a negative relationship exists between exchange rate and KLSE stock prices. Soenen and Hennigar [10] discovered that the relationship between stock prices and the US dollar is significant and negative.

According to Ibrahim and Agbaje [3], the stability of prices is vital in establishing whether the level of inflation will be constant or unstable in an economy. They also argued that inflation is the constant increase in prices over a period of time. According to Ibrahim and Agbaje [3], inflation fluctuations can create uncertainty in an economy. This uncertainty, according to them, can make both local and foreign investors unwilling to invest due to the effect they could have on their returns. These uncertainties can, however, cause an increase or decrease in price of stocks, which may affect the demand and supply of stocks in general. The consequence of this instability in price level is that it may affect potential investor's decision to invest and in turn have a negative impact on the total returns on stocks at large.

By examining the existence of causality between four macroeconomic variables (interest rate, money supply, inflation, and Foreign Direct Investment (FDI)) and stock returns in Ghana, Issahaku et al. [11] used Granger causality and vector error correction model. The result of the study showed that there exists a significant short-run relationship between inflation, exchange rate, and stock returns in Ghana. They also established that the Ghanaian stock market will take approximately 20 months to return to equilibrium in the event of changes in any of the macroeconomic variables involved in the study.

Adjasi et al. [12] analyzed the repercussions of exchange rate volatility on the Ghanaian stock market. They used data spanning from 1995 to 2005 to explain this effect. The outcome of the study showed that there is a negative relationship between exchange rate and the Ghanaian stock market returns. The methodology employed was the GARCH.

Adam and Tweneboah [13] used the Johansen cointegration technique and accounting techniques to measure the impact of macroeconomic variables on stock prices in Ghana. They looked at how consumer price index, treasury bill rate, and exchange rate could affect stock returns. Their study showed that stock prices in Ghana have a significant long-run relationship with the macroeconomic variables under study.

A study by Kuwornu and Owusu-Nantwi [2] showed that consumer price index has a significant positive effect on stock returns in Ghana. They also established that exchange rate and Treasury bill rate changes have a negative impact on the Ghanaian stock market. However, crude oil prices were not seen to have any significant impact on stocks. They adopted the full information maximum likelihood estimation procedure.

A study by Kuwornu (2012) investigated how the Ghanaian stock market can be impacted by changes in some macroeconomic variables. Kuwornu used monthly data from 1992 to 2008 and also employed the Johansen cointegration technique in analyzing the data. The macroeconomic variables involved in the study were consumer price index, exchange rate, 91-day treasury bill rate, and crude oil price. The results of the study revealed that there exists a significant long-run equilibrium relationship between the four macroeconomic variables and stock returns in Ghana.

Some studies have used models such as autoregressive fractionally integrated moving average (ARFIMA) and other techniques to establish the presence of long memory among economic variables such as inflation and exchange rate before moving on with multivariate analysis to establish relationships. Studies such as Erlat's [14] and Alptekin's [15] demonstrate how to establish the presence of a long memory component within some economic variables over time.

2. Methodology and Data

2.1. Data Collection and Source. The study made use of secondary data collected from the period from January 2000 to December 2013 consisting of monthly observations for each variable. The stock prices were sourced from the Ghana Stock Exchange (GSE), whereas the inflation and exchange rate were obtained from the Bank of Ghana.

2.2. Description and Transformation of Data. In carrying out the ARDL methodology, we used GSE market returns, exchange rate, and inflation. In order to obtain the market returns from the GSE index, we use the formula $R_i = (P_i - P_{i-1})/P_i \times 100$, where P_i is the stock price at time i and P_{i-1} is the stock price at time $i-1$. However, for inflation and exchange rate, we use the actual values obtained from the Bank of Ghana. Before applying the statistical models, each dataset was checked for stationarity (i.e., if the mean and variance are constant over time). We check this stationarity by using the Augmented Dickey-Fuller (ADF) test for stationarity. Any dataset that is not stationary is differenced using the formula $\Delta Y_t = Y_t - Y_{t-1}$. Every nonstationary dataset was differenced until it became stationary.

The procedure for testing for stationarity and the statistical models used are discussed below.

2.3. Unit Root Test (Test for Stationarity). Generally macroeconomic time series variables are found to be nonstationary. A time series data is stationary if its mean and variance are constant over time, while the value of the covariance between two time periods depends only on the gap between the periods and not the actual time at which this covariance is considered. If one or both of these conditions are not satisfied, then the process is said to be nonstationary. The stationarity of a time series data can be investigated using the Augmented Dickey-Fuller (ADF) test, Phillips-Perron test, or the KPSS test, which can be applied as a counterpart of ADF and Phillips-Perron tests.

Several studies have shown that many time series variables are nonstationary or integrated of order 1 (i.e., their first difference is stationary). In this study, the time series variables considered are the GSE market returns, exchange rate, and inflation. To apply the ARDL methodology, we first perform the unit root test on the three time series variables in the study to establish whether they are stationary or not. For this study, the Augmented Dickey-Fuller (ADF) unit root test was used for this purpose. In the application of the ADF test, three regression forms are generated:

$$\Delta Y_t = \alpha_1 Y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t,$$
$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t, \quad (1)$$
$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 t + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t,$$

where ε_t are white noise errors. The extra lagged terms are included in the model to ensure that errors are uncorrelated. The ADF test is based on the following hypotheses:

(H_0) Y_t *is not* $I(0)$ or Y_t is nonstationary.

(H_1) Y_t *is* $I(0)$ or Y_t is stationary.

To conclude on the test, we compare the calculated ADF statistics with the critical values from Fuller's table. If the test statistic is less than the critical value, then the null hypothesis (H_0) is not rejected and we conclude that the series is nonstationary or not integrated of order zero. The p value of the test can also be compared to the level of significance for drawing this conclusion. If a variable is stationary without differencing, we say it is integrated of order zero and if it is stationary only after first difference we say it is integrated of order one.

2.4. Cointegration. Variables are cointegrated if there is a linear combination of them which is stationary. If the variables in question are found to have unit roots (nonstationarity) and are of the same order, then the cointegrating relationship (i.e., the tendency of the variables to move together) between the variables in the long run can be studied by either the Engle-Granger (1987) approach, the Johansen-Juselius (1992) procedure, or the ARDL approach. However, the Engle-Granger approach and Johansen-Juselius procedure can only be used if the variables are integrated of the same order, while the ARDL can be used if the variables are integrated of unequal order. However, in this study, the ARDL methodology was used since the order of integration of variables was different.

2.5. ARDL Approach to Cointegration. In estimating the ARDL model, the best lag length *(p)* is selected by using the Final Prediction Error (FPE) criterion, Akaike Information Criterion (AIC), or Schwarz Bayesian Criterion (SBC) while ensuring that the errors are white noise. Time series (H_t) is called white noise if (H_t) is a sequence of identically distributed and independent random variables with constant mean and variance. After the determination of the appropriate lag length, the ARDL model can then be specified and estimated. Below is a description of the ARDL model in both the simple and generalized forms.

2.6. A simple ARDL Model. The ARDL (1, 1) model is given by

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \beta_0 x_t + \beta_1 x_{t-1} + \varepsilon_t, \quad (2)$$

where it is assumed that $\varepsilon_t \sim iid\,(0, \sigma^2)$ *and* $|\alpha_1| < 1$. The coefficients are interpreted as the long-run effects. ARDL (1, 1) means that both the dependent and independent variables have a lag of one. In long-run equilibrium, we expect that $y_t = y_{t-1}$ and $x_t = x_{t-1}$, so we can write (2) as

$$y_t = \alpha_0 + \alpha_1 y_t + \beta_0 x_t + \beta_1 x \Longleftrightarrow$$
$$(1 - \alpha_1) y_t = \alpha_0 + (\beta_0 + \beta_1) x. \quad (3)$$

Thus the long-run response to y of a change in x is given by

$$k = \frac{\beta_0 + \beta_1}{1 - \alpha_1}. \quad (4)$$

Now in establishing the connection between the ARDL model and the error correction model (ECM), subtract y_{t-1} from both sides of (2) and then add and subtract $\beta_0 x_{t-1}$ on the right-hand side to get

$$y_t - y_{t-1} = \alpha_0 + (\alpha_1 - 1) y_{t-1} + \beta_0 (x_t - x_{t-1}) + (\beta_0 + \beta_1) x_{t-1} + \varepsilon_t. \quad (5)$$

Substituting $\beta_0 + \beta_1 = k(1 - \alpha_1)$ from (4) and putting $\Delta y = y_t - y_{t-1}$ *and* $\Delta x = x_t - x_{t-1}$ into (5), we get

$$\Delta y_t = \alpha_0 + (\alpha_1 - 1)(y_{t-1} - k x_{t-1}) + \beta_0 \Delta x_{t-1} + \varepsilon_t. \quad (6)$$

Thus (6) is the ECM that is implied by the ARDL (1, 1) model. There are other transformations that have been considered in estimating the error correction model.

2.7. Generalization of the ARDL Model to Two Independent Variables. An ARDL (m, n) model with p exogenous variables, which can also be written as ARDL $(m, n; p)$, is given by

$$y_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i y_{t-i} + \sum_{j=1}^{p} \sum_{i=0}^{n} \beta_{ij} x_{jt-i} + \varepsilon_t, \quad (7)$$

where $\varepsilon_t \sim iid\,(0, \sigma^2)$. We might also write this, using the lag operator $L^n z_t = z_{t-n}$, as

$$\alpha(L) y_t = \alpha_0 + \sum_{j=1}^{p} \beta_j(L) x_{ij} + \varepsilon_t$$
$$\text{where } \alpha(L) = 1 - \sum_{i=1}^{m} \alpha_i L^i, \ \beta_j(L) = \sum_{j=1}^{n} \beta_{ji} L^i. \quad (8)$$

However, in the case of only one and two independent variables (i.e., ARDL $(m, n; 1)$ and ARDL $(m, n; 2)$) as in the case of this project, (7) can be written as

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \cdots + \alpha_m y_{t-m} + \beta_{01} x_{1t} + \beta_{11} x_{1t-1} + \cdots + \beta_{n1} x_{1t-n} + \varepsilon_t, \quad (9)$$

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \cdots + \alpha_m y_{t-m} + \beta_{01} x_{1t} + \beta_{11} x_{1t-1} + \cdots + \beta_{n2} x_{1t-n} + \beta_{02} x_{1t} + \beta_{12} x_{1t-1} + \cdots + \beta_{n2} x_{1t-n} + \varepsilon_t. \quad (10)$$

2.8. ARDL Model Specification as Applied to the Variables under Study. Three ARDL models will be specified and estimated. The first is between GSE market returns and inflation, the second is between the GSE market returns and exchange rate (dollar rate against the cedi), and the third is between GSE market returns on both exchange rate and inflation.

The ARDL specification of the relationship between GSE market returns, exchange rate, and inflation is given as

$$R_t = \gamma_0 + \sum_{i=1}^{m} \alpha_i R_{t-i} + \sum_{i=1}^{n} \beta_i I_{t-i} + \sum_{i=1}^{z} \varphi_i E_{t-i} + \omega_t, \quad (11)$$

where R represents GSE market returns; I represents inflation rate; E is exchange rate; m, n, and z are lag length of GSE market returns, inflation, and exchange rate, respectively; ω represents white noise error terms; α_0, β_0, and γ_0 are drift components

2.9. ECM Specification as Applied to the Variables under Study. The ECM specification of the relationship between the GSE market returns and inflation, GSE market returns, and exchange rate is given as follows:

$$R_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i R_{t-i} + \sum_{i=1}^{n} \beta_i I_{t-i} + \sum_{i=1}^{z} \varphi_i E_{t-i} + \mathrm{ECM}_{t-1} + \omega_t. \quad (12)$$

2.10. Test for Long Memory among Variables. The three variables that were used in the analysis were tested for long memory to see if there is any long-range dependency among past observations. Autoregressive fractional integrated moving average (ARFIMA) was used to determine this effect. Variables with long memory have the property of past event having a decaying effect on future events [17]. Given that d is the fractional integrated parameter, the following are the interpretations:

(i) For a fractional differencing parameter within $(0, 0.5)$, the ARFIMA process is said to exhibit long memory or long range positive dependence.

(ii) For a fractional differencing parameter within $(-0.5, 0)$, the process exhibits intermediate memory or long range negative dependence.

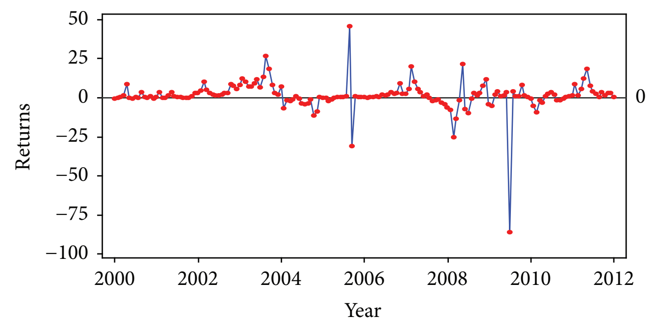

Figure 1: Time series plot of the monthly stock market returns in Ghana (2000–2013).

(iii) For a fractional differencing parameter within $[0.5, 1)$, the process is mean reverting and there is no long-run impact on future values of the process.

2.11. Empirical Analysis and Discussion. The data used for the study consist of monthly inflation rates, exchange rate (US dollar rate), and Ghana Stock Exchange (GSE) market returns. The chapter begins with a diagnostic analysis of the stationarity of the three variables (returns, inflation, and exchange rate) in the study. This is then followed by the autoregressive distributed lag (ARDL) and error correction model (ECM) methodology, which is used in determining the short- and long-run relationships between the variables.

Figure 1 shows the time series plot of the monthly GSE market returns for the period from January 2000 to December 2013. From the figure, it appears that there is an indication of stationarity of return rates.

To confirm the presence of this stationarity, the Augmented Dickey-Fuller (ADF) test was performed. The p value of the test was less than 0.05; hence, we reject the null hypothesis of unit root (nonstationarity) at 5% level of significance and thus conclude that the return rates are stationary over the period from January 2000 to December 2013. The result of the Augmented Dickey-Fuller (ADF) test is shown in Table 1. This means that the return rates are integrated of order zero ($I(0)$) since stock market returns are stationary without differencing.

Table 2 also shows the ADF test of stationarity for inflation and exchange rate. The p values show that the two variables are not stationary. Figure 1 clearly confirms this, since the plot of the level values of inflation and exchange rate (US dollar against Ghanaian cedi) shows that the mean and variance are not constant over time. This called for a transformation of the data. The ordinary differencing was used in this study. Hence, inflation and the dollar rate values were differenced. Figure 2 shows a plot of the differenced values. The plot shows that the mean and variance of the first difference of inflation (d (inflation)) and exchange rate (d (dollar)) appear to be constant over time. This is confirmed by the ADF test of stationarity. Since the p values from Table 2 are each less than 0.05, we conclude that the variables are stationary. Hence, this shows that, after first difference, inflation and exchange rate became stationary. This means

Table 1: Augmented Dickey-Fuller (ADF) unit root test for the monthly rates of inflation, exchange rate (dollar rate), and GSE market returns.

Variable	Model type	Test statistic	Critical value	p value
Inflation rate	Constant	−1.545	−2.879	0.508
	Constant + trend	−2.523	−3.437	0.317
	None	−0.712	−1.943	0.407
Exchange rate (dollar rate)	Constant	0.658	−2.879	0.991
	Constant + trend	−0.868	−3.437	0.956
	None	3.003	−1.943	0.999
Stock returns	Constant	−11.604	−2.879	0.001
	Constant + trend	−11.677	−3.437	0.001
	None	−11.385	−1.943	0.001

Table 2: Augmented Dickey-Fuller unit root test for the monthly rates of inflation and exchange rate (dollar rate) after first difference.

Variable	Model type	Test statistic	Critical value	p value
Inflation rate	Constant	−5.196	−2.880	0.001
	Constant + trend	−5.281	−3.439	0.001
	None	−5.096	−1.943	0.001
Exchange rate (dollar rate)	Constant	−5.508	−2.879	0.001
	Constant + trend	−5.58	−3.437	0.001
	None	−4.526	−1.943	0.001

that inflation rate and exchange rate are both integrated of order one $I(1)$.

2.12. The Autoregressive Distributed Lag Model (ARDL). The ARDL test according to Pesaran et al. [16] can be adopted for cointegration analysis irrespective of whether the regressors are purely $I(0)$, purely $I(1)$, or a mixture of $I(0)$ and $I(1)$. The results in Table 2 show that the stock market returns are integrated of order zero $I(0)$ and inflation and exchange rate are each integrated of order one $I(1)$; hence, the ARDL model can be applied in this case. The analysis that follows is in three folds. The ARDL model was developed using both exchange rate and inflation as independent variables to ascertain how they both affect the GSE market returns.

2.13. ARDL Model for GSE Market Returns against Inflation and Exchange Rate. The results in Table 3 show the estimates of the ADRL model describing the relationship between GSE market returns, inflation, and exchange rate. We investigate both the short- and long-run relationships and effects.

The result of the ARDL bound test for cointegration between the GSE market returns, inflation, and exchange rate is presented in Table 3. From the table, the calculated F-statistic is 5.964. This value is above the upper bounds critical value of 4.85 at the 5% significance level. This means that the null hypothesis of no cointegrating relationship can be rejected according to [16]. This implies that stock market returns are cointegrated with inflation and exchange rate. The results also imply that there exists a long-run relationship between the variables.

Next we compute the estimates of the ARDL long-run coefficient for the model and that of the error correction model (ECM) as well. Table 4 contains the long-run estimates, while Table 5 contains the estimates of the corresponding ECM. The long-run coefficients and the error correction model estimates are also provided in Tables 4 and 5. ARDL $(0,1,1)$ means that the dependent variable (GSE market returns) has a lag of zero, while each independent variable (inflation and exchange rate) has a lag of one.

Table 3: Testing for the existence of level relationship among variables in the ARDL model.

Number of regressors	Value of statistic $K = 2$
Computed F-statistic	5.964
5% critical value	
Lower bound value	3.790
Upper bound value	4.850

The critical bound values were extracted from Pesaran et al. [16].

The result of the long-run relationship between GSE market returns, exchange rate, and inflation in Table 4 shows that the coefficient of inflation and exchange rate have a positive and negative significant impact on stock returns, respectively, since their p values are less than 0.05. This means that inflation and exchange rate have a significant long-run effect on GSE market returns.

The error correction coefficient of −0.0437 (p value = 0.015) is significant and suggests a moderate speed of convergence to equilibrium. The result above again clearly shows that inflation has no significant short-term effect on GSE stock returns, while exchange rate has a short-term effect on returns.

2.14. Diagnostic Tests for Returns against Inflation and Exchange Model. The R-square value of the ARDL model

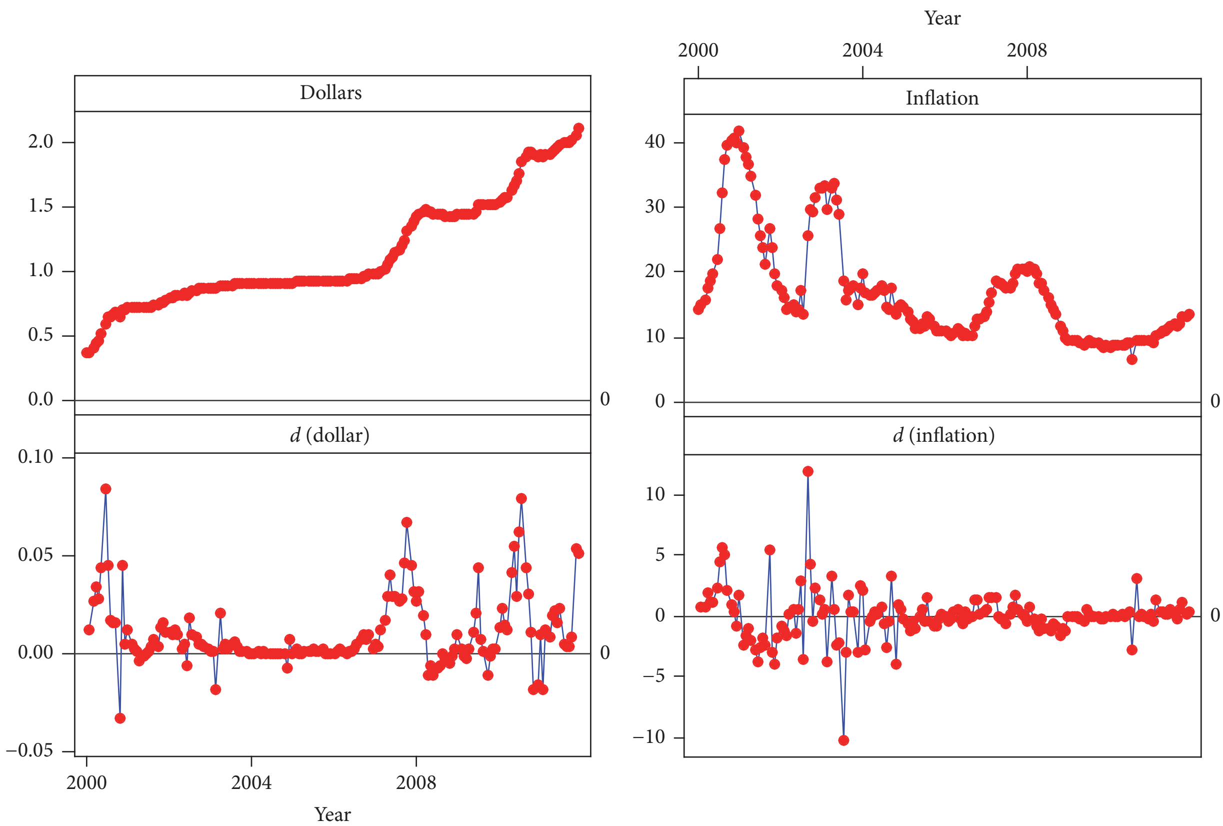

FIGURE 2: Time series plot of monthly inflation, exchange rate, and their first difference.

TABLE 4: Estimated long-run coefficients: ARDL (0, 1, 1) selected by Schwarz Bayesian Criterion.

Regressor	Coefficient	Standard error	T-Ratio	p value
Inflation	0.0527	0.7446	2.0519	0.005
Dollar	−0.0513	0.1923	−5.4651	0.001
Constant	0.2340	0.0345	6.7806	0.001

was 0.6220. This shows that the model fits reasonably well. The Lagrange multiplier test for heteroscedasticity which is distributed as chi-square has a value of 0.04195 (p-value = 0.517) and the Lagrange multiplier test for serial correlation also had a value of 0.03026 (p-value = 0.082). Also the Shapiro-Wilk test of normality had a chi-square value of 0.82 (p-value = 0.622), meaning that the assumption of normality of errors is satisfied. This shows that the diagnostic tests for serially uncorrelated errors, normality, and heteroscedasticity are satisfied at 5% level of significance. Recursive estimation of the errors also suggests that the regression coefficients are stable over the sampled period. This is because the Cumulative Sum (CUSUM) plot based on the recursive residuals given in Figure 3 does not show evidence of statistically significant breaks. The CUSUM plot below shows the stability of the stock return function.

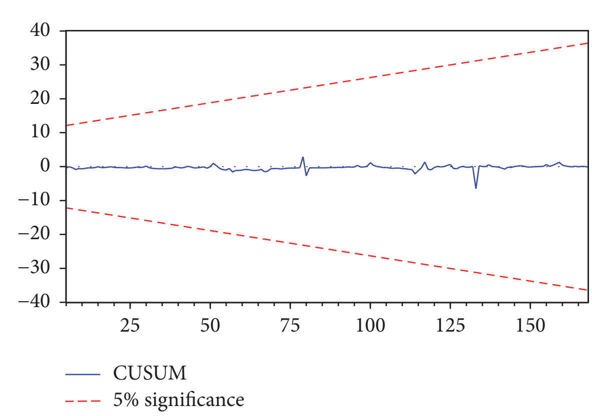

FIGURE 3: CUSUM test for stability.

2.15. Results from Long Memory Test among Variables. The results as shown in Table 6 show that all the three variables exhibited the presence of long memory dependence. However, the long memory dependence of exchange rate had a negative fractional differencing parameter indicating a long-range negative dependence. Long memory simply demonstrates that the information from "today" is not immediately absorbed by the prices in the market; therefore investors

Table 5: Error correction representation of the selected ARDL model: ARDL (1, 1, 0) selected by Schwarz Bayesian Criterion.

Regressor	Coefficient	Standard error	T-Ratio	p value
d (inflation)	0.0235	0.1239	1.8420	0.670
d (exchange rate)	−0.0365	0.1419	−2.5780	0.002
ECM (−1)	−0.0437	0.0281	−2.3240	0.015

Table 6: R output for ARFIMA results.

(a) Returns

$H = 0.950087$				
	Estimate	Std. error	z value	$\Pr(>\lvert z\rvert)$
H	0.95008698	0.09652219	9.84320	$2.22e-16$
AR	0.67345045	0.08513683	7.91021	$2.5695e-15$
MA	0.29096113	0.04087322	7.11863	$1.0901e-12$
<==> d		$:= H - 1/2 = 0.45(0.097)$		

(b) Exchange rate

$H = 0.4731915$				
	Estimate	Std. error	z value	$\Pr(>\lvert z\rvert)$
H	0.47319146	0.19269526	2.45565	0.014063
AR	0.95114946	0.05114190	18.59824	$2e-16$
MA	0.03672574	0.16671603	0.22029	0.825646
<==> d		$:= H - 1/2 = -0.027(0.193)$		

(c) Inflation

$H = 0.9390391$				
	Estimate	Std. error	z value	$\Pr(>\lvert z\rvert)$
H	0.9390391	0.3974410	2.36271	0.018142
AR	0.8831309	0.1509314	5.85121	$4.8802e-09$
MA	−0.1793681	0.2727286	−0.65768	0.510744
<==> d		$:= H - 1/2 = 0.439(0.397)$		

react with delay to any such information. This result is useful because our ARDL model indicated the presence of long-run effect of inflation and exchange rate on stock market returns. Hence, this information can be used by investors to construct trading strategies. Given these two important results, investors can reliably forecast stock values using these two variables or by considering other variables as well, since long-range dependence exists.

3. Conclusion

The objectives of the study were to examine the short- and long-run relationship between the GSE market returns, inflation, and exchange rate in Ghana. This study adopted the ARDL bounds testing approach to establish these relationships. The study showed that there exists a significant positive long-run relationship between the GSE market returns and inflation, but the short-run relationship was not statistically significant. The study also showed the existence of a statistically significant long- and short-run relationship between the GSE market returns and exchange rate (USD against the Ghanaian cedi). The speed of adjustment estimated by the error correction model for inflation and exchange rate in relation to the GSE market returns shows that the GSE market returns adjust moderately to changes in both inflation and exchange rate. This result implies that inflation and exchange rate are essential macroeconomic variables that influence the flow of investments in Ghana. The variables also showed the existence of long memory among the variables, indicating the long-range dependencies, which provides essential information for potential investors on th Ghanaian stock market.

Conflicts of Interest

The authors declare that there are no conflicts of interest and the result is not influenced by any secondary interest.

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