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Effects of Exchange Rate Volatility on the Stock Market: The Zambian Experience

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Abstract

This paper examines the effects of exchange rate volatility on the stock market in Zambia. The openness of Zambia's economy is recognized as a cause of volatility of its market. A closer look at the foreign exchange rate history in Zambia shows considerable level of volatility. No work has been done on the effect of the exchange rate volatility on the stock market, in the Zambian context. Therefore, exploring the effect of Zambia's foreign exchange rate volatility on its stock market is worthwhile. Time series data was used which span from 2000-2015. GARCH (1,1) model was used in establishing the relationship between exchange rate volatility and stock market returns. It was found that there is a negative relationship between exchange rate volatility and stock market returns. The research finding is in line with previous studies done. Based on this, it is recommended that the exchange rate movement should be stabilized and be used as a policy tool to attract foreign portfolio investment by relevant policy-makers. Also, there is need for increased use of efficient hedging instruments by firms on the stock market thus eliminating negative effects.

Keywords: Volatility, Stock return, Unit root test, GARCH, Zambia.

1. Introduction

Daily stock prices are affected by many factors such as enterprise performance, dividends, stock prices of other countries, gross domestic product, exchange rates, interest rates, current account, money supply, employment (Kurihara, 2006). Economists and researchers have recently been preoccupied by the inter temporal relation between stock returns and exchange rates since they both play important roles in influencing the development of a country's economy (Srivastav et al., 2010). Besides, the continued increases in the world trade and capital movements have made the exchange rates as one of the main determinants of business profitability and equity prices (Kim, 2003). The international competitiveness of firms, given their impact on input and output price is directly influenced by exchange rate changes (Joseph, 2002). The exchange rate and stock market relationship variable get importance because they directly affect economy of any country (Aslam, 2014). An economy's financial position is susceptible to its foreign exchange volatility. Foreign exchange market developments have cost implications for the households, firms and the state. Exchange rate volatility have real economic costs that affect price stability, firm profitability and a country's stability (Benita and Lauterbach, 2004).

On the performance of exchange rate regimes, the volatility of exchange rates is at the center of the debate. This concern was reinforced by the fluctuations in exchange rates since the move to flexible exchange rate systems in 1973 (Omojimite and Akpokodje, 2010). A major concern is the consequence of exchange rate volatility which is a prominent feature of flexible exchange rate systems. Exchange rate volatility has been a source of concern in many economies including Zambia. The financial system of a country especially the stock market is influenced by the Exchange rate volatility (Funyina, 2015). Available literature, presents divergent views of researchers and economists on whether foreign exchange rate variability influences stock market volatility (Frank and Young, 1972; Solnik, 1987; Taylor and Tonks, 1989). For example, the Asian currency crises, the advent of floating exchange rate in the early 1970s and financial market reforms in the early 1990s have prompted financial economist into determining the link between these two markets (Mishra, 2004). According to Yucel and Kurt, 2003, capital markets internationalization has resulted in inflow of vast sums of funds between countries and in the cross listing of equities which has made investors and firms more interested in the volatility of exchange rate and its effect on stock market volatility. Floating exchange rate appreciation reduces the competitiveness of export markets; and has a negative effect on the domestic stock market. But, for import dominated country, it may have positive effect on the stock market by lowering input costs.

Zambia is susceptible to foreign exchange rate volatility since it engages in international trade with several countries. The creation of the Lusaka stock exchange (LuSE) was directly linked to a broader economic package and the liberalization of the Zambia economy that began in the early 1990s.Total market capitalization has been falling since its peak in 1997, both in absolute terms and relative to GDP (Marone, 2003). Based on empirical evidence, in the contest of developed economies, there is largely inconsistency on the influence of foreign

exchange market volatility on stock market. There is no theoretical consensus on the interaction between stock prices and exchange rate (Mishra, 2004). Besides, Aslam (2014) posits that there is a negative correlation between stock market and local currency. Moreover, the openness of a country's economy is recognized as a cause of volatility of its market. Zambia is an open economy and it engages in international trade transaction. With the coming of globalization, developing country's economies are becoming more integrated into developed economies with the results of increasing flow of imports and exports. A closer look at the foreign exchange rate history in Zambia shows some considerable level of volatility. To my knowledge, no work has been done on the effect of the exchange rate volatility on the stock market, in the Zambian context. Therefore, exploring the effect of Zambia's foreign exchange rate volatility on its stock market is worthwhile. Thus this study looks at the effect of foreign exchange rate movements on the stock market in Zambia.

2. Literature Review

There have been a number of studies examining the causal nexus between exchange rates and stock prices . These studies provide mixed results. A study by Wickremasinghe (2012) on the relationship between stock prices and exchange rates in Sri Lanka used monthly data on four foreign exchange rates and the All Share Price Index (ASPI) of the Colombo Stock Exchange in the empirical analysis. The Johansen's cointegration test found no long-run relationships between stock prices (ASPI) and any of the four exchange rates during the sample period. Furthermore, the study found one unidirectional relationship from stock prices to the US dollar exchange rate for short-run in-sample causal relationships between stock prices and exchange rates.

In Malaysia, Ibrahim (2000) examined both bivariate and multivariate cointegration and Granger causality between exchange rates and stock prices. This study used three measures of exchange rate, nominal effective exchange rate, real effective exchange rate and the exchange rate between the Malaysian ringgit and the US dollar. This study did not find any cointegrating relationship between exchange rate measures and stock prices in the bivariate models,but there was cointegration between measures of exchange rate and stock prices when money supply (*M*2) and reserves were included in the cointegrating relationship. Findings of the multivariate model indicated that a concerted stance on exchange rate, monetary and reserve policies is vital for stock market stability, in the short run.

Abdalla and Murinde (1997) investigated the interaction between the real effective exchange rates and stock prices in Korea ,India, Pakistan and the Philippines. They found unidirectional causalities from exchange rates to stock prices in all sample countries except in the Philippines. Also, Granger et al. (2000) studied the causal relationships between exchange rates and stock prices. Their study reported that the data from South Korea were consistent with the traditional approach that exchange rates lead stock prices. Conversely, the data for the Philippines were consistent with the portfolio approach: stock prices lead exchange rates with negative correlation. Data from Hong Kong, Singapore, Malaysia, Taiwan and Thailand indicated strong feedback relations. The data for Japan and Indonesia did not find any causal relationship.

Also, Nieh and Lie (2001) studied G7 countries for relationship between exchange rate and stock market using data from 1993 to 1999. Their study indicated that there is no long run relationship that exists between the two variables. Though short run significant relationship exists between few G7 countries with USA having no relationship in between their exchange rate and stock market . Sekmen (2011) examined the effects of exchange rate volatility, using the squared residuals from the autoregressive moving average (ARMA) models, on stock returns for the U.S. for the period 1980 to 2008. The study indicated that, exchange rate volatility negatively affected U.S. stock returns, since the availability of hedging instruments could not lessen the negative effect of exchange rate volatility on trade volume. In another study, Olugbenga (2012) examined the short-run and long-run effects of exchange rate on stock market development in Nigeria over 1985– 2009 using the Johansen cointegration tests. Study results showed a significant positive stock market performance to exchange rate in the short-run and a significant negative stock market performance to exchange rate in the long-run.

Adjasi and Biekpe (2005) investigated the relationship between stock prices and exchange rate movement using a VAR model, in South Africa, Ghana, Egypt, Nigeria ,Kenya and Mauritius. Their study findings indicated that there was no long-run stable relationship between exchange rates and stock market prices for South Africa, Ghana, Egypt, Nigeria ,Kenya and Mauritius. In another study, Pilinkus and Boguslauskas (2009) used the impulse response function to test the existence of the short-run relationship between macroeconomic variables and stock market prices. Their study indicated that exchange rate , unemployment rate, and short-term interest rates, negatively influence stock market prices.

Empirical literature investigated by the study shows that there are mixed views on the link between exchange

rate and the stock market, thus drawing a verdict for the relationship between the two variables from existing literature is not possible. Studies by Alam and Tafiques (2007) admit that there is need for continuous research in the area of exchange rate volatility and stock markets. Morales (2008), provides room for further research to be done in this area in order to establish more comprehensively the true nature of spillovers from exchange rates to equity markets. Using the period of study from 2000 -2015, this study tries to examine the stock market in Zambia and the exchange rate and a conclusion will be made if there is any causal relationship that exists between two variables or not. In Zambia, even though some works have been done on modelling exchange rate volatility and on stock and treasury bill markets, information on the exchange rate volatility and the stock market is hard to come across and/or, it is not available.

3. Methodology

3.1 Empirical Model

The GARCH (1,1) process

To determine volatility, Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models are widely used. Let (Z_n) be a sequence of independently and identically distributed (i.i.d.) random variables such that $Z_t \sim N(0,1)$. (X_t) is called the Generalized Autoregressive Conditionally Heteroskedastic or $GARCH(q, p)$ process if

$$X = \sigma Z, \qquad t \in Z \tag{1}$$

where (σ_t) is a nonnegative process such that

$$\alpha_t^{\,2} = \alpha_o + \alpha_1 X_{t-1}^{\,2} + \ldots + \alpha_q X_{t-q}^{\,2} + \beta_1 \sigma_{t-1}^{\,2} + \ldots + \beta_p \sigma_{t-p}^{\,2}, \ t \in Z \tag{2}$$

and

$$\alpha_o > 0, \ \alpha \geq 0 \quad i = 1,\ldots,q \quad \beta_i \geq 0 \quad i = 1,\ldots,p. \tag{3}$$

The conditions on parameters ensure strong positivity of the conditional variance (2).
Writing equation (2) in terms of the *lag-operator B* you get

$$\sigma_t^{\,2} = \alpha_o + \alpha(B) X_t^{\,2} + \beta(B)\sigma_t^{\,2}, \tag{4}$$

where

$$\sigma(B) = \alpha_1 B + \alpha_2 B^2 + \ldots + \alpha_q B^q$$

and

$$\beta(B) = \beta_1 B + \beta_2 B^2 + \ldots + \beta_p B^p \tag{5}$$

If the roots of the characteristic equation, i.e.

$$1 - \beta_1 x - \beta_2 x^2 - \ldots - \beta_p x^p = 0$$

lie outside the unit circle and the process (X_t) is stationary, then (2) can be written as

$$\sigma_t^{\,2} = \frac{\alpha_o}{1-\beta(1)} + \frac{\alpha(B)}{1-\beta(B)} X_t^{\,2}$$

$$= \alpha^*_o + \sum_{i=1}^{\infty} \delta X_{t-i}^{\,2} \tag{6}$$

$\alpha^*_o = \dfrac{\alpha_o}{1-\beta(1)}$, and δ_i are coefficients of B^i in the expansion of $\alpha(B)[1-\beta(B)]^{-1}$.

Expression (6) tells us that the GARCH(q, p) process is an ARCH process of infinite order with a fractional structure of the coefficients. From (2), the GARCH(q, p) process is stationary if the process ($\sigma_t^{\,2}$) is stationary (Posedel,2005).

3.2 Model Specification

In order to measure the effect of exchange rate volatility on the stock market in Zambia, this study uses the GARCH model. The explanatory variables that are included in this study's model are: exchange rate volatility (LEVOL), inflation rate (LINF) and gross domestic product (LGDP). Thus the stock market capitalization (LSMC) is expressed as a function of the explanatory variables.

$$LSMC = f(LEVOL, LINF, LGDP) \quad (7)$$

$$LSMC = \beta_o + \beta_1 LEVOL + \beta_2 LINF + \beta_3 LGDP + \varepsilon_t$$

Where LSMC is the stock market capitalization, EVOL is the exchange rate volatility, INF is the inflation rate, GDP is the gross domestic product, ε_t is a white noise error term and the L in the above model stands for natural logs.

3.3 Data Sources

This study uses secondary data from the Lusaka Stock Exchange (LuSE), a principal stock exchange of Zambia and a member of the African Stock Exchanges Association. Additional data was also obtained from the Central Statistical Office of Zambia (CSO), a statistics bureau This study uses time series data from 2000 to 2015.

4. Results and Discussions

4.1 Unit Root Test

Empirical work based on time series data assumes that the underlying time series is stationary. Broadly speaking, a data series is said to be stationary if its mean and variance are constant over time and the value of covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed (Gujrati ,2003). Researchers use unit root test to distinguish if data has stationary Autocorrelation Function (ACF) or partial autocorrelation function (PACF) figure diagnosis. It is too arbitrary to use figure diagnosis to judge variable's stationary. There are various methods of testing stationarity of a series. The most common ones are: The Augmented Dickey–Fuller (ADF) Test and Phillips–Perron (PP) Unit Root Tests. This study used Augmented Dickey–Fuller test (ADF) that it is purposed to eliminate error term correlations. The test statistics is given as:

$$\Delta Y_t = \beta_1 Y_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta Y_{t=i} + \varepsilon_i \quad (9)$$

Where ε_t is a white noise error term and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$

The testable hypothesis is:

H_o : β_1 and α_i are equal to zero (β_1 and $\alpha_i = 0$)

H_1 : β_1 and α_i are less than 0 (β_1 and $\alpha_i < 0$)

If H_o is rejected, then there is no unit root in the series.

Table 1 below shows results of unit root test. Except for Gross Domestic Product , all the variables were differenced once in order to induce stationary thus eliminating the possibility of having a spurious relationship. Besides, the exchange rate volatility was generated through GARCH (1,1) process.

Table 1: Unit root test results

Variable	Test Statistic	1% critical value	5% critical value	10% critical value	MacKinnon p-value
Market Capitalization	-5.501	-3.750	-3.000	-2.520	0.0000
Gross Domestic Product	-7.502	-3.914	-2.369	-2.612	0.0000
Inflation Rate	-6.103	-3.470	-2.292	-2.647	0.0000
Exchange Rate Volatility	-4.398	-3.564	-2.639	-2.507	0.0000

Table 2 shows the GARCH (1,1) model results. Of all the variables in the mean and variance equation, none were significant except for the exchange rate volatility (LEVOL). From the results, the relationship between stock market capitalization and exchange rate volatility is negative. This means that a unit increase in exchange rate volatility will decrease stock market capitalization by 0.15 units. This concurs with findings by Ibrahim and Aziz (2003); and Kim(2003) in which they reported a significant negative relationship between the two variables.

Table 2: GARCH (1,1) model results

Dependent Variable: LSMC

Observations: 14 Distribution: Gaussian Log likelihood = -239.0415 Wald chi2(2) = 13.87	
Mean Equation	
Variable	**Coefficient**
LINF	0.005605
LGDP	0.192199
Variance Equation	
C	0.360303
RESIDE	0.015691
GARCH	0.005294
LEVOL**	-0.150801
LINF	0.004036

Note: Significance level: *** ($p \leq 0.01$); ($p \leq 0.05$); ** ($p \leq 0.10$)*

5. Conclusion and Recommendations

This study was undertaken to determine the effect of exchange rate volatility and on the Stock Market in Zambia. The study used data from 2000-2015.The study results shows that they exist an inverse relationship between exchange rate volatility and stock market returns. This means that global economic conditions affect the stock market in Zambia. Thus the exchange rate volatility has a serious implication on the Zambian stock market. A volatile exchange rate may create uncertainty in investors as to whether to invest or not in the market. This study thus recommends; (i) the need for policy maker's intervention in times of abnormal exchange rate volatility so as to boost investor confidence (ii) the need for increased use of efficient hedging instruments by firms on the stock markets thus eliminating negative effects (iii) the exchange rate movement should be stabilized (stock market return reduces due to exchange rate depreciation)and be used as a policy tool to attract foreign portfolio investment by relevant policy-makers (iv) The need for policymakers to deepen the capital market depth and build a robust stock market that will stand the test of time.

Lastly, since exchange rate volatility in developing countries, including Zambia, is high than in developed countries (Funyina, 2015), there is need for continuous research on exchange rate volatility in relation to other macroeconomics variables such as money supply, treasury bills and exogenous factors such as the United States interest rates.

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