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Effect of Unexpected Exchange Rate Movements on Value of Multinational Nonfinancial Companies Listed at Nairobi Securities Exchange

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Abstract:
The study investigates the effects of unexpected exchange rate movements on value of multinational nonfinancial companies listed at Nairobi securities exchange for period 2001-2016. Contemporaneous exchange rate changes and lagged exchange rate movements were used as control variables. The study adopted a two staged methodology. The first stage involved the determination of the foreign exchange exposure. At this point the REER is determined as the weighted average of the seven major currencies used by Kenya. The unexpected foreign exchange changes were determined using the ARIMA and GARCH model. The second stage of analysis involves a panel model where different aspects of foreign exchange exposure are regressed on firm value. The results indicated that unexpected exchange rate changes have a negative significant influence on the value of nonfinancial companies listed at the Nairobi Securities Exchange. The results of the study were inconclusive on the effects of lagged changes in exchange rates on firm value. The findings of the study reveal that unexpected exchange rate changes have a significant negative influence on firm value.

Keywords: *Unexpected exchange rate, lagged exchange rates, contemporaneous exchange rate, firm value*

1. Background of the Study

Exchange rate changes can affect an individual investor who owns a portfolio consisting of securities in different currencies; a multinational company with subsidiaries and branches in foreign locations; an exporter/importer who concentrates on international trade and even a firm that has no direct international activities (El-Masry, 2006). Furthermore, exchange rate changes, through their impact on the costs of inputs, outputs, and substitute goods, play a significant role in determining the competitive position of domestic companies with no direct international operations relative to foreign firms (Joseph, 2002).

As businesses are increasingly interconnected globally, foreign exchange rate movements have been perceived as one of the most important sources of uncertainty to firms' cash flows and profitability (Afza & Alam, 2011). Changes in foreign currency exchange rates can affect firm value since they directly affect a firm's current and future cash flows. Evidence also suggests that this disparity results as many firms are able to manage their foreign exposure by passing through its effects to customers or by engaging in financial or operational hedging (Carter, Pantzalis, & Simkins, 2006; Bartram, Brown, & Minton, 2010).

Overall, theory supports the existence of a relationship between the value of the firm and exchange rate movements. Economic theory suggests that changes in the exchange rate can produce a shift in stock prices, directly in the case of multinational firms, exporting and importing companies, firms which import part of their inputs and indirectly for other companies (El-Masry &Abdel-Salam, 2007). Exchange rate movements affect both the prices of imported finished goods and the costs of imported inputs, thus influencing indirectly those companies that compete with such firms (Grambovas and McLeay, 2006).

Studies on foreign exchange rate exposure and firm value was pioneered by Jorion (1990) who examined the relationship between stock returns and exchange rates, by performing an empirical analysis among US multinational

companies. He presented evidence showing that the relationship between stock returns (value) and exchange rates differs systematically across multinational companies. The degree of foreign exchange rate exposure on firm value was found to be positively related to the percentage of foreign involvement. More specifically; the empirical evidence suggests that exchange rate fluctuations do affect firm value (Gentry, 2012; Choi & Prasad, 2005). Fama (2008) has mathematically established that operative hedging through the creation of operational flexibility represents a strategic complement to any variance minimizing financial hedge. The study shows that there exists a strategic complement between financial and real option-based operative hedging. Given this, one should expect that firms use both financial and operational hedging techniques (Madura, 2009).

According to El-Masry (2006), changes in exchange rate can influence firm current and future expected cash flows and ultimately, stock prices. The direction and magnitude of changes in exchange rate on firm's value are a function of a firm's corporate hedging policy which indicates whether the firm utilizes operational hedges and financial hedges to manage currency exposure and the structure of its foreign currency cash flows (Bartram, 2008). The Purchasing power parity theory which refers to rates of changes of price levels, that is, inflation rates, states that the rate of appreciation (depreciation) of a currency is equal to the difference in inflation rates between the foreign and the home country (Sarno & Taylor, 2002).

Foreign exchange risk is a major concern for investors and managers alike (Du, 2010). One of the difficulties in managing foreign exchange risk - whether from an investor's or a manager's point of view – is measuring the extent to which companies are exposed to the risk. Fundamentally addressing the problem of measuring exchange rate operating exposure involves analyzing the competitive position of the specific company, the dynamics of that company, as well as the dynamics of the markets in which the company is involved. A shortcut to the measurement problem may be to exploit the information content in the stock prices. According to Adler and Dumas (2010) exchange rate exposure can be measured by the regression coefficient (or coefficients if more than one currency) when a stock's price is regressed on exchange rate(s) (Takatoshi, 2013).

Authors have used this stock market approach to measure the extra-market exchange rate exposure of companies on an industry level (Adler & Dumas, 2010; Aggarwal, & Harper, 2010) as well as on a company level (e.g. Jorion, 1990). Most of the analyses involve US data and in spite of selection procedures (e.g. only inclusion of companies with reported foreign operations) that should favor findings of exposures, they tend to fail finding significant relations between the changes in exchange rates and the contemporaneous changes in stock prices. Using a stock market approach this study examined the exchange rate exposure of nonfinancial firm listed at NESM from January 2001 to December 2016 employing monthly frequency of the data.

2. Literature Review

The basic understanding of exchange rate exposure is the sensitivity of a firm's market value to a change in exchange rate. An unexpected change in exchange rate might have an impact on firm's value. The impact could arise due to influence of exchange rate on firm's cash flow, foreign sales, foreign competition and so on (Williamson, 2001; Bartram & Karolyi, 2006). Accordingly, a change in exchange rate could create gain or loss and make a change in firm's value. Adler and Dumas (1984) develop a measure of exchange rate risk exposure. They point out that the concept of exposure is arbitrary in sense that stock prices and exchange rates are determined jointly. Consequently, the unexpected changes in the exchange rate can be calculated as the difference between the actual and anticipated changes in exchange rates using the time series model; ARIMA and/or GARCH (Tai, 2005; Bartram, 2008).

Doukas, Hall and Lang (2003) examined the relation between Japanese stock returns and unanticipated exchange-rate changes for 1,079 firms traded on the Tokyo stock exchange over the 1975–1995 period. Second, they investigated whether exchange-rate risk is priced in the Japanese equity market using both unconditional and conditional multifactor asset pricing testing procedures. The study found a significant relation between contemporaneous stock returns and unanticipated yen fluctuations. The exposure effect on multinationals and high-exporting firms, however, was found to be greater in comparison to low-exporting and domestic firms. This, further justify the focus of this study on multinational nonfinancial firms listed in the NSE.

Glaum (2005) carried out an empirical analysis on foreign exchange risk management in German non-financial corporations and found interesting discrepancies between the positions of the academic literature and corporate practice. He found that numerous firms are concerned about their accounting exposure and some firms are actively managing it. Of the three definitions of exposure offered by financial literature, namely translation, transaction and economic exposure, only economic exposure is considered to be consistent with financial theory (Bartram, Dufey & Frenkel, 2005). However, Glaum (2005) found out that although economic exposure is favoured by the academic literature, it is of little importance in practice.

Li, Lin and Hong (2010) studied the impacts of unexpected changes in exchange rate on firms' value in Taiwan. The study examined the exposure of firms to exchange rate fluctuations by both employing the Generalized Autoregressive Conditional Heteroskedasticity Model (GARCH) and the Classical Linear Regression Model (CLRM). Panel regression analysis was used to find the determinants of exchange rate exposure, such as firm size, export ratio, quick ratio and long-term debt ratio. The empirical findings in the present study were summarized as follows: It was positive and significant exposure of foreign exchange risk. Firms with a larger size, a higher quick ratio or a higher long-term debt ratio were inclined to have a lower exposure in exchange rate. However, the export ratio of a firm had little impacts on the firm's exchange rate exposure.

3. Methodology

The population for the current study constituted the 19 multinational nonfinancial companies listed at the Nairobi Securities Exchange. Multinational firms engage in a many foreign currencies denominated transactions which subject their cash flows to foreign exchange exposures. The study used secondary data with two data sets for a 16-year period from 2001 to 2016. Data on monthly share prices was sourced from NSE monthly reports whereas the average monthly exchange rates were sourced from Central Bank of Kenya

To identify the unexpected changes in exchange rates the study fitted a time series model for the REER using the Autoregressive Integrated Moving Average (ARIMA) According to El-Masry (2006), ARIMA models are used to extract unexpected changes in exchange rates from the series of exchange rate (or interest rates) movements. However, ARIMA models as first modelled for the data are not characterised as robust for the volatility that is attributed with conditional heteroscedasticity and autocorrelation of the disturbance term. Consequently, the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model was used. The fitted values of the model correspond to the expected changes in exchange rate risk factor. The residuals are then defined as the unanticipated changes in exchange rates.

The study used contemporaneous exchange rate changes and one month lagged changes in exchange rates as control variables. Contemporaneous exchange rates were computed for every month in the period of study as the current changes in the real effective exchange rates. The real effective exchange rate (REER) is computed as weighted average of the different real exchange rates (RER) from the basket of currencies where the weights are determined on importance of the country based on the terms of trade between the countries.

Seven major currencies were selected to constitute the basket from which the foreign currency exchange rates are determined. This includes; US Dollar, Euro, Sterling Pound, Japanese Yen, South African Rand, Tanzanian Shillings and Ugandan Shillings. The currencies were selected since they constitute Kenya's largest foreign exchange volumes. The formula used for the computation of the real exchange rates (RER) from the NER in the study is given by;

$$RER = NER \times \frac{p^*}{p}$$

Where p^* is the price levels of the foreign currency p the price level of the domestic currency and NER the nominal exchange rate. Further the study adopted the formula constructed by Broeck and Slok (2001) for real exchange rates from relative prices and nominal exchange rates by the real exchange rate decomposition;

$q_t = s_t - p_t^* + p_t$

Where q_t is the real exchange rate, s_t the nominal exchange rate, p_t^* the foreign country's price levels p_t the domestic country's price levels all in natural logarithms?

With the natural logarithms of the individual from the individual decomposed RERs, the resulting equation adopted to compute the REER that was adopted was an arithmetic weighted average of the individual logged RERs of a basket of currencies.

$$REER = \sum_{i=1}^{m} W_i \times rer_i$$

Where $rer_i = \log_e RER_i$ is the natural log of the real effective exchange rate of currency i
W_i is the weight given to the currency i which is determined by trading volumes.

4. Results and Discussion

The descriptive statistics of the individual exchange rates for each currency for the entire period was determined and presented in table 1. The results show very varying figures on the mean nominal exchange rates between Kenya shillings and each of the currencies. This shows that Kenya trades highly with countries with both strong currencies and weak currencies. Five of the currencies considered in the basket were all stronger than the Kenya shilling, the Sterling Pound being the strongest that had a mean NER of 132.460. The other two currencies in the basket that were on the other hand found to be on average weaker than the Kenya shilling were the Tanzanian shillings and the Ugandan shillings with mean NERs of 0.061 and 0.038 respectively.

The strong currencies in the basket that were trading with Kenya are globally strong and very marketable currencies globally such as the dollar that had a mean NER of 81.566 against the Kenya shilling over the 190 months combined. The weaker currencies on the other had were regional currencies that trade with Kenya by virtue of regional trade and being neighbouring countries to Kenya. The coefficient of variations indicated that Japanese Yen and Tanzanian shillings had the highest spread (20%) over the study period with Sterling pound depicting the lowest spread (8%) indicating that it is the most stable of the selected currencies. Madura (2011) argues that foreign exchange rate movements tend to be larger for longer time horizons thus the longer the time horizon the higher the spread.

Currency	Mean	Std Deviation	Min	Maximum	C.V
Euro	100.133	14.896	66.458	132.94	15%
US Dollar	81.566	8.929	64.631	102.606	11%
Sterling Pound	132.46	11.087	110.742	156.914	8%
Japanese Yen	78.964	15.621	58.529	123.189	20%
SA Rand	9.664	1.788	6.226	17.396	19%
Tanzanian Shillings	0.061	0.012	0.046	0.098	20%
Ugandan Shillings	0.038	0.005	0.028	0.047	13%

Table 1: Nominal Exchange Rates Summary Statistics

A further analysis of the nominal exchange rates (NER) shows that the NER is very heterogeneous across the different currencies. As shown on the spaghetti plot in figure 4.8 of the different currencies in one graph, some of the currencies have high NERs like the Sterling Pound that is constantly above the others and above 100 while the others like the Ugandan shilling and the Tanzanian shilling are barely above 0 throughout the period.

Having fitted a model that could predict the real effective exchange rates, predictions based on the ARCH (1)-M model with ARIMA (2,1,2) as the mean model was used to predict the effective exchange rates. The residuals from the model were then extracted as the unexpected changes in the effective exchange rates. The process is in line with Fang and Loo (2004) who also used ARIMA models to examine the effect of current and unexpected exchange rate changes on US bank common stock returns. Table 2 shows the summary statistics of the unexpected changes in exchange rates. The mean of the unexpected changes is 0.002 with a standard deviation of 0.047. This implies that the unexpected changes exhibit periodic fluctuations about 0.

	Mean	Std Deviation	Min	Maximum
Unexpected movements	0.002	0.047	-0.293	0.186

Table 2: Summary Statistics for Unexpected Changes in Exchange Rates

Figure 1 shows the graphical presentation of the plot of the generated unexpected changes in the effective exchange rates against time. The plot is actually a residuals plot of the ARCH-M with ARIMA mean model used to fit the exchange rates prediction. The residuals are the difference in the expected and anticipated rates from the actual rates that gives the definition of the unexpected exchange rates. The plot shows that the changes were fluctuating about zero across the period both in the negative and positive directions.

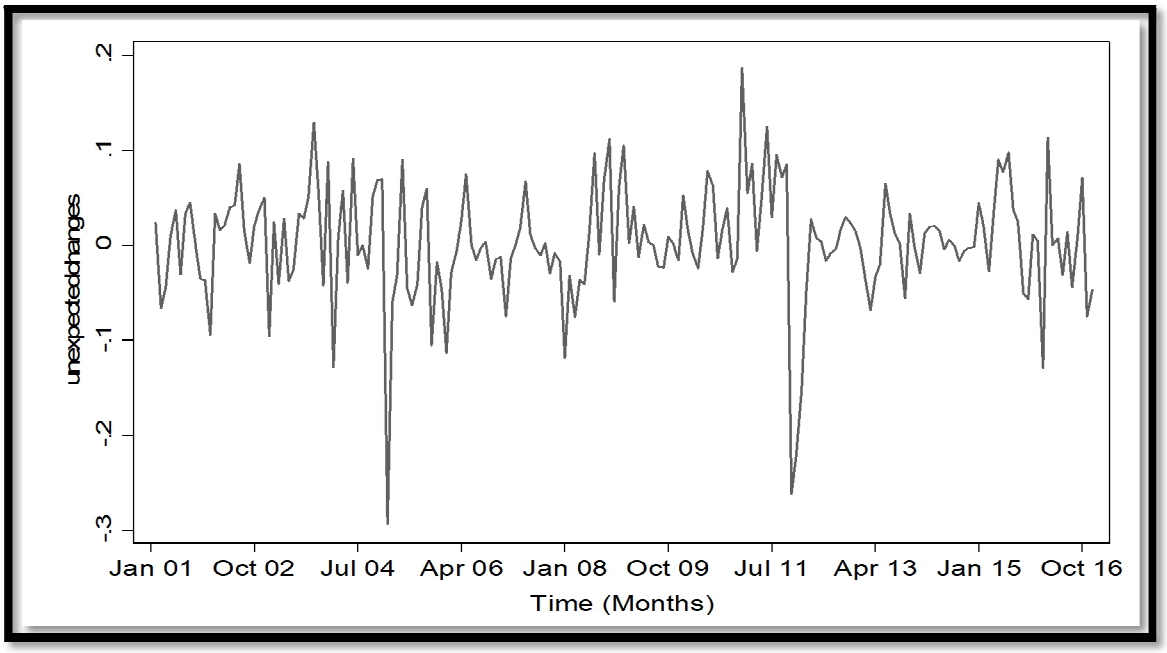

Figure 1: Unexpected Changes in Exchange Rates with Time

The objective of the study was to determine the effect of unexpected exchange rate movements on firm value of nonfinancial companies at Nairobi Securities Exchange. The resulting data of the unexpected returns was therefore used as a variable in the panel data consisting of the 19 firms over a period of 190 months. The results are presented in table 3. The overall mean was found to be 0.002 with an overall standard deviation of 0.047. The overall variation is however equal to the

variation within the groups of NSE listed companies as shown by the equal standard deviations. There is no variation between the firms themselves as implied by the standard deviation of 0 between the groups.

Variable		Mean	Std. Dev.	Min	Max	Observations
Unexpected movements	overall	0.002	0.047	-0.293	0.186	N=3591
	between		0.000	-0.001	-0.001	n=19
	within		0.047	-0.293	0.186	T=188

Table 3: Unexpected Changes Panel Analysis Statistics Summary

The study carried out the pre-estimation diagnostic tests. The Breusch Pagan Lagrange Multiplier test was also done as a model specification test for the multiple joint influences of the independent variables on firm value It indicates that there were no significant differences on firm value cross the entity securities and therefore the random effects model is expected yield the same results as the pooled OLS model. The Hausman specification test was then used to determine the appropriate and more viable model of the random effect and the fixed effect. Based on the results of the Hausman model specification test results that favoured the random effect model, Table 4presents the summary statistics for the random effect model of the joint effect on firm value.

The lagged changes were however found not to have significant influence on firm value at 5% significance level as shown by the p-value of 0.316 which is greater than 0.05. Contemporaneous and unexpected changes in exchange rates were found to have a significant influence on firm value.

	Coefficients.	Std. Err.	z	P>|z|
Contemporaneous changes	-5.763	1.442	-4.000	0.000
Unexpected changes	-30.547	3.926	-7.780	0.000
Lagged changes	1.231	1.227	1.000	0.316
Constant	1.214	0.178	6.830	0.000
sigma_u	0.000			
sigma_e	10.435			
Rho	0.000			

Table 4: RE Model Coefficients Table for the Joint Effect
Fraction of Variance Due To U_I

Post estimation diagnostic Wooldrige test was used as a test for serial correlation and the p-value of the f-statistic was found to be 0.0007 which is less than 0.05 implying the existence of first order autocorrelation of the error term. This implicated that the fitted model violated the assumption of non-autocorrelation of the error term. A Wald test of homoscedasticity was done to test for group wise heteroscedasticity using a chi-square statistic. The results showed presence of heteroscedasticity and violation of group wise homoscedastic error terms. The normality test used the Jacque Bera approach. The p-values of the chi-square statistics for both u and e were found to be less than 0.05 (p=0.000) implying that the error terms do not follow a normal distribution. Breusch-Pagan Lagrangian multiplier test for cross-sectional independence gave a p-value for the chi-square as 0.000 which is less than 0.05 implying presence of cross-sectional dependence.

The random effect model fitted violated all the classical assumptions tested of cross sectional independence, non-serial correlation, normality and panel homoscedasticity of the residuals. The study therefore used GLS. A panel GLS model that allows for auto correlated and heteroscedastic errors and cross-sectional dependence was then fitted to ensure the model fitted was heteroscedastic robust and allowed for serial correlation and correctional dependence. Bootstrapped standard errors were used on the FGLS model due to the violation of normality in the random effect model fitted. The results are presented in table 5.

Considering the fitted GLS model, the p-value of the t-statistic for the estimated coefficient of unexpected exchange rate movements is 0.000 which is less than 0.05. The null hypothesis was rejected at 0.05 level of significance and a conclusion drawn that unexpected exchange rate movements has a negative significant influence on firm value of nonfinancial companies at Nairobi Securities Exchange. This depicts an inverse relationship between unexpected exchange rate movements and firm value. It implies that unexpected exchange rate movements may lead to depletion of firms' value and further justifies the need for hedging.

The findings of the study concur with those of earlier studies (Li, Lin & Hong, 2010; Doukas, Hall & Lang, 2003). Li, Lin and Hong (2010) studied the impacts of unexpected changes in exchange rate on firms' value in Taiwan and found a positive and significant exposure of foreign exchange risk. Doukas, Hall and Lang (2003) examined the relation between Japanese stock returns and unanticipated exchange-rate changes for 1,079 firms traded on the Tokyo stock exchange over the 1975–1995 period.

Firms are exposed to foreign exchange risk if the results of their projects depend on future exchange rates and if exchange rate changes cannot be fully anticipated. Abor, (2005) posits that foreign exchange risk is commonly defined as the

additional variability experienced by a multinational corporation in its worldwide consolidated earnings that results from unexpected currency fluctuations. Generally, companies are exposed to three types of foreign exchange risk: transaction (commitment) exposure, economic (operational, competitive or cash flow) exposure and translation (accounting) exposure. Economic risk relates to adverse impact on equity/income for both domestic and foreign operations because of sharp, unexpected change in exchange rate (Madura, 2003).

Coefficients: generalized least squares
Panels: heteroskedastic with cross-sectional correlation
Correlation: common AR (1) coefficient for all panels (0.1706)

Estimated covariances = 190
Estimated autocorrelations = 1
Estimated coefficients = 4
Number of Obs = 3572
Number of groups =19
Time periods =188
Wald chi2(3) =41.29
Prob > chi2 =0.000

	Coefficients	Bootstrap Std. Err.	z	P>|z|
Contemporaneous changes	-4.912	1.306	-3.760	0.000
Unexpected changes	-22.526	3.546	-6.350	0.000
Lagged changes	1.513	1.096	1.380	0.168
Constant	1.138	0.190	5.980	0.000

Table 5: Generalised Least Squares Model

5. Conclusion and Recommendation

From the results of the study it is concluded that unexpected exchange rate changes have a negative significant influence on the value of nonfinancial companies listed at the Nairobi Securities Exchange. The joint effect model found that of the three factors considered, unexpected exchange rate changes was the most influential with influence about twice as much as that of contemporaneous changes. This shows how important it is to consider the unexpected changes to determine expectations on share prices for investment in NSE stock market. Unexpected exchange rate changes are deduced from prediction of anticipated exchange rates. It is therefore recommended that investors take keen interest in proper time series estimation modeling for expected changes in foreign exchange rates for informed investment decisions in stock markets.

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