Journal of Economics Library
www.kspjournals.org
Volume 5 March 2018 Issue 1

The impact of macroeconomic variables on stock prices in Tanzania

By Manamba EPAPHRA [a†] & Evidence SALEMA [b]

Abstract. This paper examines the relationship between stock prices and macroeconomic variables namely, inflation rate, Treasury bill rate, exchange rate and money supply in Tanzania. The paper uses monthly time series data spanning from January 2012 to December 2016 across 10 companies listed on the Dar es Salaam Stock Exchange. Johansen's co-integration and vector error correction models have been applied to investigate the long-run relationship between stock prices and macroeconomic variables while considering average stock price on one hand and individual companies stock prices on the other hand. We specify 11 models, whereas model 1 examines the effects of macroeconomic variables on overall stock price, models 2-11 explore the effects of the same macroeconomic variables on individual firm's stock price across 10 firms. This is important because some firms tend to behave differently as far as changes in macroeconomic variables are concerned. The empirical analysis reveals that macroeconomic variables and the stock prices are co-integrated across all models and, hence, a long-run equilibrium relationship exists between them. Equally important, all regression models pass the specification tests of heteroscedasticity, serial correlation, Ramsey RESET test of specification and Jacque-Bera Normality test. The overall model regression results show that money supply and exchange rate have a positive effect on stock prices. By contrast, Treasury bill rate tends to have a negative effect on stock prices. Inconsistent with the a priori expectation, inflation rate seems to exert no impact on overall stock prices. However, individual firms' regressions show that the coefficient on inflation is negative and statistically significant in 6 models but weakly significant in 2 models, and positive and statistically significant in 1 model. Similar controversial results across firms are revealed on the other macroeconomic variables while considering individual firms regressions. Nevertheless, money supply is found to be the main determinant of stock and hence, it should be targeted as the main monetary policy aimed at directing the stock market in Tanzania.
Keywords. Stock prices, Macroeconomic variables, Error correction models.
JEL. D51, H54, O24.

1. Introduction

The company valuation and market capitalization for the firms listed on the Dar es Salaam Stock Exchange (DSE) have been influenced by dynamic change in macroeconomic variables. As a result, it has impacted stock prices. This movement of stock prices makes the investors feel uncomfortable due to future performance of the firms listed on DSE. In assuring that the investors are in comfort zone about the fluctuation of stock prices, these investors need to know the influence of key macroeconomic variables.

It is worth noting that several researches have been done to examine the relationship between stock prices and macroeconomic variables. However, some

[a†] Department of Accounting and Finance, Institute of Accountancy Arusha, Tanzania.
☎. +255 754 399 775
✉. emanamba@iaa.ac.tz
[b] Bank of Tanzania, Tanzania.
☎. +255(0)789380220
✉. evidss@gmail.com

contradictions arise from these previous studies. In fact, some studies, for example Kyereboah-Coleman & Agyire-Tettey (2008); Ibrahim & Aziz (2003); Wongbangpo & Sharma (2002); Rafique *et al.*, (2013); Maysami *et al.*, (2004) and Horobet & Dumitr (2009) argue that the macroeconomic variables, notably exchange rate, interest rate, inflation rate and money supply have a significant relationship with stock prices. Other studies such as Ali (2011); Bhattacharya & Mookherjee (2001) and Mohammad *et al.*, (2009) show that these macroeconomic variables exert no influence on stock prices. Also, literature shows that among the macroeconomic variables, some tend to have a significant impact on stock prices while others tend to have no statistical relationship with stock prices (see for example Pal & Mittal, 2011; Ullah *et al.*, 2014; Kurihara, 2006).

Generally, the effects of macroeconomic variables on stock price invite a debate to investors, policy makers and academics. For example, it is widely known that when the interest rate is low it will result into a flow of the capital out of the country. This may result into currency depreciation and thus, according to this theory, when the currency depreciates it results into lower stock prices. Similarly, when the bank deposit rate increases people tend to redirect their money from stock market to the banks, which in turn lead to a decline in the demand for shares on stock markets. The basic intuition here is that, from the point of view of a borrower, interest rate is the cost of borrowing money while from a lender's point of view, interest rate is the fee charged for lending money. Undoubtedly, Uddin & Alam (2007) and Muktadir-al-Mukit (2012) show that interest rate has a negative relationship with stock price. Also, many studies (Flannery & James, 1984; Dinenis & Staikouras, 1998; Lynge & Zumwalt, 1980; Prasad & Rajan, 1995; Sweeney & Warga, 1986) provide evidence of a significant negative relationship between changes in interest rates and stock returns of both financial and nonfinancial companies.

Despite the fact that the impacts of interest rate on stock prices provide important implications for monetary policy, risk management practices, financial securities valuation and government policy towards financial markets (see Alam & Uddin, 2009), there are some reasons that justify a positive relationship between the two variables. According to Benigno (2016), interest rates and equity markets may move in the same direction following changes in macroeconomic factors such as economic prospects, and due to the existence of flight-to- quality effects from stocks to bonds in an environment of increased financial market uncertainty.

A number of previous studies show that changes in stock prices can be explained by money supply. Notwithstanding, the empirical studies conducted in this field still provide ambiguous results. According to Mukherjee & Naka (1995), if money supply brings the economic stimulus then the resulting corporate earnings in turn will increase the stock prices. However, when the increase in money supply causes an increase in inflation, then an increase in money supply will raise the discount rate and therefore reduce the stock prices. Indeed, Mukherjee & Naka (1995); Maysami *et al.* (2004); Ratanapakorn & Sharma (2007); Homa & Jaffe (1971); Kochin & Hamburger (1972) reveal a positive relationship between money supply and stock prices, while Rahman *et al.* (2009) show that the relationship between the two variables is negative.

Similarly, inflation and exchange rates play a great role in the performance of stock prices. Notably, many previous studies suggest that the impact of inflation on stock price is negative and statistically significant (Jaffe & Mandelker, 1976; Lintner, 1973; Schwert & Fama, 1977) while some studies suggest the relationship between the two variables is either positive (Firth, 1979) or statistically insignificant (Khan, 2012). Similar controversial relationships can be observed on the relationship between exchange rate and stock prices (see for example Doong *et al.*, 2005; Aggarwal, 1981; Singh *et al.*, 2011). These controversies suggest that the relationship between macroeconomic factors and stock prices across countries is inconclusive and so, it provides motivation for further studies. The basis for controversy is indeed, wide but mainly may be due to differences in nature of data, macroeconomic situations of countries, and methodologies used for analysis. Nonetheless, these controversies pose a challenge for policy formulation and direction. In fact, empirical investigation of the relationship between macroeconomic variables and stock prices appears to be much important for a specific country. Thus, considering the significance of stock exchange and macroeconomic variables to the economy of Tanzania, it is important to understand the relationship between these variables, which would help to formulate appropriate macroeconomic policies for a country.

The general objective of this paper is to examine the influence of selected macroeconomic variables on overall stock prices on one hand, and on individual company's stock prices on the other hand. To achieve this objective, the paper uses monthly stock price data spanning from January 2012 to December 2016 for 10 companies listed on DSE. Ideally, the paper aims at providing appropriate policy measures on stock price variation as far as changes in macroeconomic variables are concerned. DSE was incorporated in September 1996 but started trading in April 1998. It is a member of the African Stock Exchanges Association, holding the sixth position as the largest stock exchange by trade volumes.

2. Conceptual framework

As has been mentioned, the general idea of this paper is to examine the impact of selected macroeconomic variables on stock prices. Many previous studies reveal macroeconomic variables such as inflation, interest rate, exchange rate and money supply as main determinants of stock prices. However, the relationship between stock prices and these macroeconomic variables is not straight forward and in some cases, literature has produced controversial results across countries. For example, although, inflation is seen as negative news by the stock market, the relationship between inflation and stock returns can be positive or negative depending on whether the economy is facing unexpected or expected inflation (Talla, 2013). On one hand, if inflation is expected, an increase in prices would increase firms' earnings which in turn would lead to paying more dividends and hence increase the price of their stock. On the other hand, when inflation is unexpected, an increase in price may lead to the increase in cost of living which in turn shifts resources from investment to consumption. Moreover, an increase in inflation may lead to increase in nominal interest rate, accordingly the discount rate that is used to determine the intrinsic value of stocks will increase ipso facto. The increase in discount rate may reduce the present value of net income leading to lower stock prices. Similarly, the fact that high interest rate increases the opportunity cost of holding; leading to substitution of stocks for interest bearing securities, an increase in interest rate will result into a decrease in stock prices. Thus, interest rate is expected to be negatively associated with stock returns.

The other important variables are money supply and exchange rate. Money supply is widely expected to have a positive impact on stock prices because an increase in money stocks stimulates the economic activities which in turn lead to an increase in credit that is available to firms, again leading to production expansion and then increase in sales. An increase in sales would increase firms' earnings and a subsequent increase in stock prices. However, money supply and inflation have a positive relationship among them and thus, have a dual effect on stock returns; the impact of money supply on stock prices can be negative as well. Increase in money supply and inflation would increase the nominal risk free rate which in turn leads to a rise in the discount rate and a fall in return. Nonetheless, in this paper, we expect a positive impact of money supply on stock prices. A depreciation of the local currency against foreign currencies or an increase in exchange rate is expected to have a negative effect on stock prices. Depreciation tends to increase exports but increase the cost of imports. For this reason, importing companies would have lower earnings and lower share price. Unsurprisingly, the stock market tends to react negatively to currency depreciation, however, such relationship is complex. In fact, as has been mentioned, the fact that depreciation makes domestic products cheaper to foreign buyers, domestic exporting companies tend to benefit from currency depreciation. Thus, like many other macroeconomic variables, the effect of exchange rate on stock prices can be either a positive or a negative. Based on previous studies such as Talla (2013) and Doong *et al*., (2005), we assume the negative relationship between exchange rate and stock prices is predominant.

3. Methodology

3.1. Model Specification

A framework to examine the effects of macroeconomic variables on average stock price and stock prices of individual companies and commercial banks namely Tanzania Breweries Limited (TBL), TOL Gases Limited (TOL), Tanzania Tea Packers (TATEPA), Tanzania Cigarette Company Limited (TCC) Tanga Cement Company Ltd (TCCL), Tanzania Portland Cement Company (TPCC), Dar es Salaam Community Bank (DCB), National Microfinance Bank (NMB), and CRDB Bank (CRDB) is specified as

Model 1: Average Stock Price

$$\Delta LSP_t = \alpha_0 + \alpha_1 \Delta\pi_t + \alpha_2 \Delta LER_t + \alpha_3 \Delta TB_t + \alpha_4 \Delta LM2_t + u_{1t} \quad (1)$$

Model 2: Tanzania Breweries Limited

$$\Delta LSP\_TBL_t = \beta_0 + \beta_1 \Delta\pi_t + \beta_2 \Delta LER_t + \beta_3 \Delta TB_t + \beta_4 \Delta LM2_t + u_{2t} \quad (2)$$

Model 3: TOL Gases Limited

$$\Delta LSP\_TOL_t = \gamma_0 + \gamma_1 \Delta\pi_t + \gamma_2 \Delta LER_t + \gamma_3 \Delta TB_t + \gamma_4 \Delta LM2_t + u_{3t} \quad (3)$$

Model 4: Tanzania Tea Packers

$$\Delta LSP\_TATEPA_t = \lambda_0 + \lambda_1 \Delta\pi_t + \lambda_2 \Delta LER_t + \lambda_3 \Delta TB_t + \lambda_4 \Delta LM2_t + u_{4t} \quad (4)$$

Model 5: Tanzania Cigarette Company Limited

$$\Delta LSP\_TCC_t = \theta_0 + \theta_1 \Delta\pi_t + \theta_2 \Delta LER_t + \theta_3 \Delta TB_t + \theta_4 \Delta LM2_t + u_{5t} \quad (5)$$

Model 6: Tanga Cement Company Ltd

$$\Delta LSP\_TCCL_t = \delta_0 + \delta_1 \Delta\pi_t + \delta_2 \Delta LER_t + \delta_3 \Delta TB_t + \delta_4 \Delta LM2_t + u_{6t} \quad (6)$$

Model 7: Swissport Tanzania Plc.

$$\Delta LSP\_SWISS_t = \varphi_0 + \varphi_1 \Delta\pi_t + \varphi_2 \Delta LER_t + \varphi_3 \Delta TB_t + \varphi_4 \Delta LM2_t + u_{7t} \quad (7)$$

Model 8: Tanzania Portland Cement Company

$$\Delta LSP\_TPCC_t = \phi_0 + \phi_1 \Delta\pi_t + \phi_2 \Delta LER_t + \phi_3 \Delta TB_t + \phi_4 \Delta LM2_t + u_{8t} \quad (8)$$

Model 9: Dar es Salaam Community Bank

$$\Delta LSP\_DCB_t = \psi_0 + \psi_1 \Delta\pi_t + \psi_2 \Delta LER_t + \psi_3 \Delta TB_t + \psi_4 \Delta LM2_t + u_{9t} \quad (9)$$

Model 10: National Microfinance Bank

$$\Delta LSP\_NMB_t = \zeta_0 + \zeta_1 \Delta\pi_t + \zeta_2 \Delta LER_t + \zeta_3 \Delta TB_t + \zeta_4 \Delta LM2_t + u_{10t} \quad (10)$$

Model 11: CRDB Bank

$$\Delta LSP\_CRDB_t = \xi_0 + \xi_1 \Delta\pi_t + \xi_2 \Delta LER_t + \xi_3 \Delta TB_t + \xi_4 \Delta LM2_t + u_{11t} \quad (11)$$

Where

$$\left.\begin{array}{l} \alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4 \\ \beta_0, \beta_1, \beta_2, \beta_3, \beta_4 \\ \gamma_0, \gamma_1, \gamma_2, \gamma_3, \gamma_4 \\ \lambda_0, \lambda_1, \lambda_2, \lambda_3, \lambda_4 \\ \theta_0, \theta_1, \theta_2, \theta_3, \theta_4 \\ \delta_0, \delta_1, \delta_2, \delta_3, \delta_4 \\ \varphi_0, \varphi_1, \varphi_2, \varphi_3, \varphi_4 \\ \phi_0, \phi_1, \phi_2, \phi_3, \phi_4 \\ \psi_0, \psi_1, \psi_2, \psi_3, \psi_4 \\ \zeta_0, \zeta_1, \zeta_2, \zeta_3, \zeta_4 \\ \xi_0, \xi_1, \xi_2, \xi_3, \xi_4 \end{array}\right\} = \textit{Parameters to be estimated in } 11 \textit{ models}$$

$t = 1, ...T$ = the period of time, years

u	=	white noise error term, i.e. $u_t \sim N(0, \sigma^2)$
Δ	=	the first difference operator

The variables appearing in the equations are defined as follows

LSP_t	=	Average stock price, logarithm
LSP_TBL_t	=	Tanzania Breweries Limited stock price, logarithm
LSP_TOL_t	=	TOL Gases Limited stock price, logarithm
LSP_TATEPA_t	=	Tanzania Tea Packers stock price, logarithm
LSP_TCC_t	=	Tanzania Cigarette Company Limited stock price, logarithm
LSP_TCCL_t	=	Tanga Cement Company Ltd stock price, logarithm
LSP_SWISS_t	=	Swissport Tanzania Plc. Stock price, logarithm
LSP_TPCC_t	=	Tanzania Portland Cement Company stock price, logarithm
LSP_DCB_t	=	Dar es Salaam Community Bank stock price, logarithm
LSP_NMB_t	=	National Microfinance Bank stock price, logarithm
LSP_CRDB_t	=	CRDB Bank stock price, logarithm
π	=	Inflation rate, percentage
LER	=	Exchange rate, logarithm
TB		Treasury bill rate, percentage
$LM2$		Money supply, logarithm

The log-linear functional forms are adopted to reduce the possibility or severity of heterogeneity. The hypotheses can be confirmed or denied based on the estimated individual values of α_i, β_i, γ_i, λ_i, θ_i, δ_i, φ_i, ϕ_i, ψ_i, ζ_i *and* ξ_i in the regression analyses, where $i = 0, 1, 2, 3, 4$. The null hypotheses are $H_0 : \alpha_i = 0$, $H_0 : \beta_i = 0$, $H_0 : \gamma_i = 0$, $H_0 : \lambda_i = 0$, $H_0 : \theta_i = 0$, $H_0 : \delta_i = 0$, $H_0 : \varphi_i = 0$, $H_0 : \phi_i = 0$, $H_0 : \psi_i = 0$, $H_0 : \zeta_i = 0$, *and* $H_0 : \xi_i = 0$ *i.e* the coefficients in each regression are not different from zero. The alternative hypotheses are
$H_1 : \alpha_i \neq 0$, $H_1 : \beta_i \neq 0$, $H_0 : \gamma_1 \neq 0$, $H_1 : \lambda_i \neq 0$, $H_1 : \theta_i \neq 0$, $H_1 : \delta_i \neq 0$, $H_1 : \varphi_i \neq 0$, $H_1 : \phi_i \neq 0$, $H_1 : \psi_i \neq 0$, $H_1 : \zeta_i \neq 0$, *and* $H_1 : \xi_i \neq 0$ i.e. the coefficients in each regression are different from zero. *t-test* is used to test the significance of the coefficient of each variable included in the model, while the *F-test* is applied to test whether the coefficients are jointly or simultaneously equal to or different from zero. This also implies that the significance of coefficients on the variables are tested individually and jointly. All variables except inflation rate and treasury bill rate are in logarithm form.

3.2. Unit Root Tests

Many macroeconomic and financial time series such as inflation rate, Treasury bill rate, exchange rates, money supply and stock exhibit stochastic trends or nonstationarity. These stochastic or trends, may cause spurious regressions since the test statistics will no longer follow the t or F distributions. However, such non stationary variables can be made stationary by transforming them into their differences. A time series, Z_t is said to be stationary if its mean and variance are time invariant. Approaches such as Dickey-Fuller *(DF)* test, augmented Dickey-Fuller *(ADF)* test, Phillips-Perron *(PP)* test and DF-GLS test are widely used for testing stationarity or unit root. These tests consider the null hypothesis that the series is not stationary. This paper uses *ADF* test. The ADF test makes a parametric correlation for higher-order correlation by assuming that the series follows autoregressive process and adjusting the test methodology. Moreover, the ADF approach controls for higher-order correlation by adding lagged difference terms of the dependent variable to the right-hand side of the regression (also see Epaphra, 2016).

The basic idea behind the *ADF* unit root test for nonstationarity is to regress Z_t on its lagged value Z_{t-1} and find out if the estimated ρ is statistically equal to 1 or not in the model

$$Z_t - Z_{t-1} = (\eta - 1)Z_{t-1} + \varepsilon_t \qquad (12)$$
$$\Delta Z_t = \rho Z_{t-1} + \varepsilon_t$$

where $\rho = (\eta - 1)$, and Δ is the first difference operator. Equation (12) is estimated and tested for the null hypothesis of $\rho = 0$ against the alternative of $\rho \neq 0$. If $\rho = 0$, then $\eta = 1$, indicating that the series is nonstationary (also see Epaphra, 2016).

Figures 1-4 give visual information about the data generating process in levels. Two variables namely, inflation rate and Treasury bill rate seem to have downward trends while other variables namely, average stock price, exchange rate and money supply have upward trends. In fact, inflation rate declined from 19.7 percent in the 1st month (January 2012) to 6.0 percent in the 26th month (February 2014). It further went down to 5.0 percent in the 60th month (December 2016) after several months of fluctuations. Similarly, Treasury bill rates, declined from 13.7 percent in the 1st month to 11.8 percent in the 18th month (June 2013), and 9.9 percent in the 45th month (September 2015) after a few months of fluctuations. By contrast, average stock price index increased from 1261.5 in the 1st month (January 2012) to 5286 in the 39th month (Mach 2015) before declining to 3769.0 in the 60th month (December 2016). Likewise, exchange rate (TZS/US$) rose from 1572.28 in the 1st month to 2170.4 in the 60th month. Also, Money supply increased from TZS 13005.7 billion in the 1st month to TZS 22877.9 billion in the 60th month. In general, these trends indicate that all the variables in consideration have no constant means and have a long memory in their decreasing or increasing trends. The overall implication at this elementary stage is that all variables have unit root and might be integrated of order one to make them stationary. Accordingly, it becomes inevitable to test the stability of the regression models in this analysis.

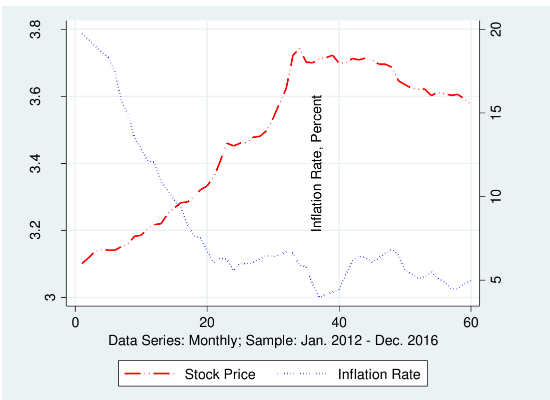


Figure 1. *Stock Price vs. Inflation Rate, Jan. 2012-Dec. 2016*

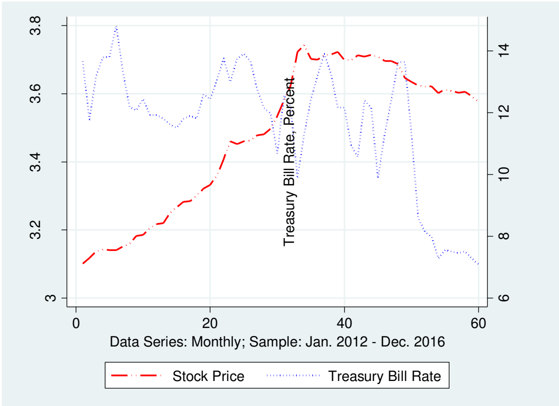


Figure 2. *Stock Price vs. Treasury Bill, Jan. 2012-Dec. 2016*

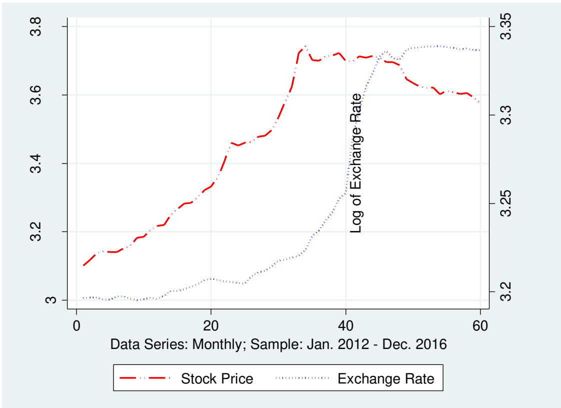


Figure 3. *Stock Price vs. Exchange Rate, Jan. 2012-Dec. 2016*

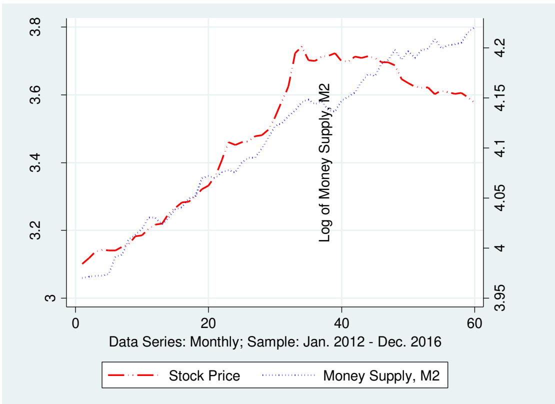


Figure 4. *Stock Price vs. Money Supply, Jan. 2012-Dec. 2016*

3.3. Cointegration Test and Error Correction Model

Having concluded that the series are non stationary at level but when integrated of order one they become stationary, the next step is to test the possibility of cointegration or long run relationship among the variables used in the regression models. Granger & Engle (1987) two-step estimation procedure and Johansen (1988) procedure are two procedures that are widely used to test for presence or absence of the long run relationship. Granger & Engle (1987) two-step estimation procedure involves normalizing the cointerating vector on one of the variables, which makes the assumption that the corresponding element of the cointegrating vector is non-zero while the Johansen procedure is a multivariate approach. It builds cointegrated variables directly on maximum likelihood estimation instead of relying on OLS procedures (Johansen &Juselius, 1988). This paer uses the Johansen (1988) procedure. This approach enables one to determine the number of existing cointegrating relationships among the variables in consideration. The Johansen test is performed if all the variables in the regression model are integrated of order one, $I(1)$. The variables that are to be tested for cointegration are stacked into a *p*-dimensional vector z_t, then a $p\times 1$ vector of first differences, z_t, is constructed, and estimate the vector autoregressive model

$$\Delta z_t = \Pi z_{t-k} + \Gamma_1 \Delta z_{t-1} + \Gamma_2 \Delta z_{t-2} + \ldots + \Gamma_{k-1} \Delta_{t-(k-1)} + \varepsilon_t \quad (13)$$

The rank of the matrix Π is tested. If Π is of zero rank (i.e. all the eigenvalues are not significantly different from zero), there is no cointegration, otherwise, the rank will give the number of cointegrating vectors (also see Brooks, 2008). It is worth noting that the Johansen and Juselius maximum likelihood test is done on the variables in their non-stationary form and the trace test and maximum eigenvalue test, are as expressed respectively as

$$J_{trace} = -T \sum_{i=r+1}^{n} \ln\left(1 - \hat{\lambda}_i\right) \quad (14)$$

$$J_{\max} = -T \ln\left(1 - \hat{\lambda}_{r+1}\right) \quad (15)$$

where J_{trace} is the trace statistic, $J_{\max}$ is the eigen-max statistc, T is the sample size and $\hat{\lambda}_i$ is the *i*th largest canonical correlation. The trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors whereas the maximum eigenvalue test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of $r+1$ cointegrating vector (Hjalmarsson & Österholms, 2007).

When the variables are co-integrated or have the long run equilibrium relationship then it is possible to run the Error Correction Model (ECM). According to the Granger Representation Theorem (GRT), if a number of variables, such as Z_t and X_t, are cointegrated, then there will exist an ECM relating these variables and *vice versa*. Conditional on finding cointegration between Z_t and X_t, the estimate of β from the first step long-run regression may then be imposed on the following sort-run model with the remaining parameters being consistently estimated by the OLS. In other words, we retrieve the estimate of ψ from the long run regression, $Z_t = \psi X_t + u_t$ where variables Z_t and X_t are non-stationary, and insert it in place of ψ the error-correction term $\left(Z_t - \psi X_t\right)$ in the following short-run equation:

$$\Delta Z_t = \gamma_1 \Delta X_t + \gamma_2 \left(Y - \psi X\right)_{t-1} + \varepsilon_t \quad (16)$$

where Δ represents first-differences and ε_t is the error term. Alternatively, in practice, since $Z_t - \psi X_t = u_t$, one can substitute the estimated residuals from equation $Z_t = \psi X_t + u_t$ in place of the error-correction term, as the two will be identical. Note that the estimated coefficient γ_2 in the short-run equation (16) should have a negative sign and be statistically significant. Note also that, to avoid an explosive process, the coefficient should take a value between -1 and 0. According to the GRT, negative and statistically significant γ_2 is a necessary condition for the variables in hand to be cointegrated. In practice, this is regarded as a convincing evidence and confirmation for the existence of cointegration found in the first step. It is also important to note that, in the second step of the *ECM*, there is no danger of estimating a spurious regression because of the stationarity of the variables ensured. Combinations of the two steps then provide a model incorporating both the static long-run and the dynamic short-run components.

3.4. Estimation procedure and validity of data

The paper uses official data from Bank of Tanzania and Dar es Salaam Stock Exchange. Although some variables namely stock prices, exchange rate and money supply were transformed into logarithm forms and that overall stock prices were obtained by taking the averages of 10 individual company's stock prices, we believe that data are valid and reliable. In estimating the models employed, we first test for stationrity and contegration using ADF test and Johansen maximum likelihood procedure respectively. Next, a series of error correction models are estimated and are re-assessed in terms of the diagnostic tests such as residual autocorrelation, normality and heteroskedasticity. The purpose of which is to ensure data admissibility and then consider whether the model is consistent with theory. Basic estimation technique used is ordinary least squares (OLS) method. The OLS method has been used over a wide range of economic relationship with fairly satisfactory results. Despite the improvement of computational equipment and statistical information, OLS is still one of the most commonly employed methods in estimating relationships in econometric models. This is because of its simplicity and appropriateness.

4. Empirical results

4.1. Descriptive statistics of data

Table 1 reports a summary statistics of the average stock prices, stock prices of individual companies and selected macroeconomic variables for the period spanning from January 2012 to December 2016 giving rise to 60 observations. As reported earlier, stock prices index, exchange rate and money supply are in logarithm form. The Table presents among others the minimum, maximum, mean, skewness and kurtosis of each variable. These descriptive statistics provide a historical background for the behavior of the data. The statistics suggest that there are no outliers since the mean of each variable is relatively close to its median. The values of skewness and kurtosis show the normality test. For a variable to be normally distributed its skewness value should be equal to zero whereas the kurtosis value should be three. Specifically, skewness gives a measure of how symmetric the observations are about the mean while kurtosis gives a measure of the thickness in the tails of a probability density function (also see Epaphra, 2016). Similarly, under the null hypothesis of normal distribution, if the calculated p-value of the Jarque-Bera (JB) is greater than 0.05, we fail to reject the null hypothesis at 5 percent level of significance. Thus, as the Table reports, we fail to rejected the null hypothesis that LSP_TCCL, LSP_DCB, LSP_NMB, and LM2 are normally distributed. Nevertheless, all the variables except inflation posses skewness and kurtosis values that are not far from 0 and 3 respectively. These results imply that the variables are close to normal distribution. However, it is worth noting that if the skewness coefficient is in excess of unity it is considered fairly extreme and the low (high) kurtosis value indicates extreme platykurtic (extreme leptokurtic). The value of standard deviation indicates that inflation rate and the Treasury bills rate are relatively more volatile as compare to other variables over the January 2012-December 2016 period. Furthermore, the standard deviation indicates that the exchange rate and money supply are less volatile compared to the rest of the macroeconomic variables during the same time.

4.2. Correlations and graphical analysis

Table 2 and Figures 5-8, respectively, present the correlation matrix and scatter plots among the variables. Specifically, scatter plots show a correlation between the average stock price (LSP) and each of the four regressors, inflation rate, Treasury bill rate, exchange rate and money supply. As far as correlation is concerned, results in Table 2 suggest that there is a positive correlation between overall stock price index and exchange rate and money supply. The correlation coefficients between overall stock price and exchange rate on one hand, and money supply on the other hand are in fact very high suggesting that stock price index moves in the same direction with exchange rate and money supply. However, some individual company's stock prices seem to behave differently. For example, DCB stock price tends to move in opposite direction with both exchange rate and money supply. In addition, TCCL stock price seems to move negatively with exchange rate.

In the same manner, a negative correlation is observed between overall or average stock prices and inflation rate on one hand, and Treasury bill rates on the other hand. Among these two macroeconomic variables inflation rate seems to have highly correlation with overall stock price. Overall stock price, by contrast, seems to have a low correlation with Treasury bill rate. However, like money supply and exchange rate, inflation and Treasury bill rate tend to have a controversial correlation with individual company's stock prices. For example, Table 2 shows that stock prices of TCCL, TPCC, and DCB tend to increase with treasury bill rates while DCB stock price also tends to move in the same direct with inflation rate. Macroeconomic variables such inflation and exchange rate show high variability. Apparently, the price level in Tanzania has been largely unstable, fueled mainly by unstable money supply as well as frequently changing international oil prices.

Before turning to the baseline regression results, we show the observed relationship between average stock price and macroeconomic variables using scatter diagrams (Figures 5-8). Although we cannot comment on causation, the results reported in all Figures reveal information on the strength of the relationships connecting the overall stock price and macroeconomic variables. In fact, the observed negative relationship between stock price and inflation rate is in line with most of the findings in the literature. Similarly, stock price and Treasury bill rate seem to be negatively correlated. By contrast, Figures 7 and 8 indicate that overall stock price tends to increase with exchange rate and money supply. This simple analysis supports the inclusion of these macroeconomic variables in our baseline regression analysis. Notwithstanding these correlations do not necessarily mean causations. In addition, pair-wise correlations can be spurious, reflecting the effect of the presence of unit roots. Thus, it is very important to examine these relationships in a multivariate regression analysis. In this case, macroeconomic variables that are considered key determinants of overall stock price and individual company's stock prices should be included.

Table 1. *Descriptive Statistics, January 2012 – December 2016*

	LSP	LSP_TBL	LSP_TOL	LSP_TATEPA	LSP_TCC	LSP_TCCL	LSP_SWISS	LSP_TPCC	LSP_DCB	LSP_NMB	LSP_CRDB	LE	π	TB	LM2
Mean	1.48	3.87	2.63	2.74	3.95	3.41	3.51	3.44	2.75	3.33	2.43	3.25	8.19	11.61	4.12
Median	3.56	4.02	2.68	2.81	4.06	3.38	3.43	3.42	2.75	3.40	2.48	3.22	6.35	12.17	4.12
Max	3.74	4.23	2.94	2.81	4.24	3.75	3.88	3.65	2.99	3.66	2.70	3.34	19.73	14.82	4.22
Min	3.10	3.31	2.30	2.42	3.50	3.20	2.94	3.32	2.60	2.93	2.07	3.20	3.98	7.09	3.97
Std. Dev.	0.21	0.33	0.22	0.13	0.25	0.13	0.30	0.08	0.08	0.22	0.19	0.06	4.42	2.05	0.08
Skewness	-0.41	-0.46	-0.06	-1.39	-0.59	0.74	-0.31	0.88	0.51	-0.43	-0.64	0.61	1.48	-0.99	-0.28
Kurtosis	1.65	1.45	1.43	3.28	1.96	3.00	1.80	2.64	3.37	1.95	2.08	1.56	3.91	2.96	1.83
JB	6.27	8.14	6.21	19.44	6.15	5.52	4.61	8.13	2.94	4.61	6.20	8.94	23.94	9.80	4.21
Prob.	0.05	0.02	0.05	0.00	0.15	0.06	0.10	0.02	0.23	0.10	0.05	0.01	0.00	0.01	0.12
Obs	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

Source. Authors estimates

Table 2. *Correlation Matrix, January 2012 – December 2016*

	LSP	LSP_TBL	LSP_TOL	LSP_TATEPA	LSP_TCC	LSP_TCCL	LSP_SWISS	LSP_TPCC	LSP_DCB	LSP_NMB	LSP_CRDB	LER	π	TB	LM2
LSP	1														
LSP_TBL	0.99	1													
LSP_TOL	0.91	0.93	1												
LSP_TATEPA	0.85	0.82	0.75	1											
SLSP_TCC	0.99	0.96	0.87	0.89	1										
LSP_TCCL	0.39	0.28	0.06	0.14	0.39	1									
LSP_SWISS	0.94	0.93	0.96	0.82	0.93	0.19	1								
LSP_TPCC	0.63	0.53	0.35	0.42	0.63	0.89	0.50	1							
LSP_DCB	-0.01	-0.08	-0.16	-0.34	-0.04	0.67	-0.08	0.55	1						
LSP_NMB	0.90	0.88	0.71	0.87	0.93	0.46	0.75	0.59	-0.09	1					
LSP_CRDB	0.92	0.89	0.77	0.87	0.94	0.41	0.85	0.64	-0.03	0.88	1				
LER	0.70	0.74	0.91	0.53	0.65	-0.18	0.86	0.13	-0.20	0.40	0.55	1			
π	0.85	-0.82	-0.76	-0.97	-0.89	-0.15	-0.85	-0.43	0.27	-0.86	-0.85	0.55	1		
TB	-0.37	-0.42	-0.62	-0.35	-0.33	0.42	-0.51	0.22	0.47	-0.20	-0.18	-0.67	0.40	1	
LM2	0.92	0.93	0.98	0.83	0.90	0.02	0.97	0.34	-0.26	0.75	0.80	0.88	-0.84	-0.62	1

Source. Authors estimates

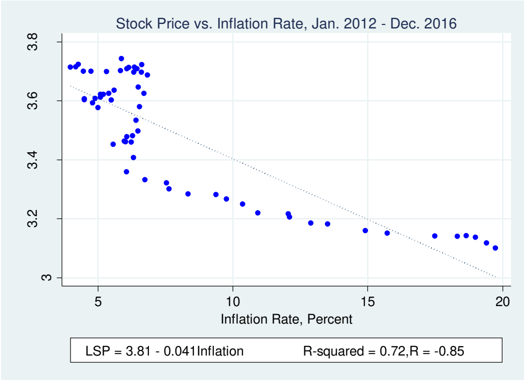


Figure 5. *Stock Price and Inflation Rate, Jan. 2012- Dec. 2016*

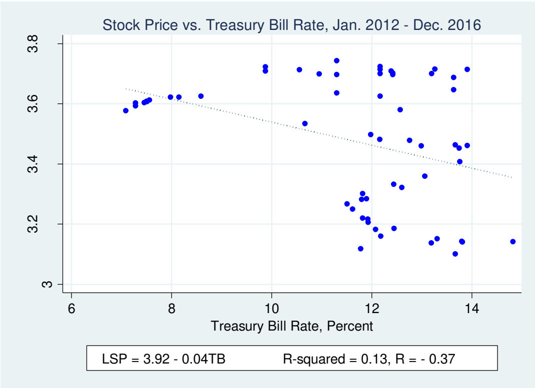


Figure 6. *Stock Price and Inflation Rate, Jan. 2012-Dec. 2016*

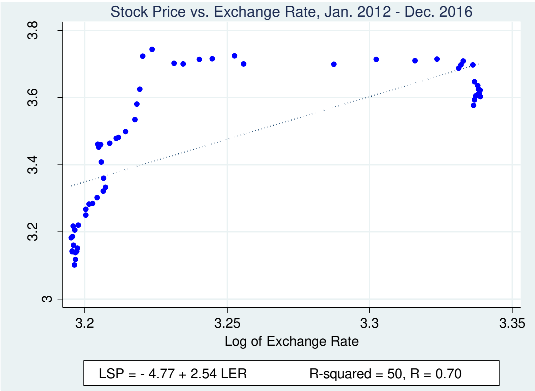


Figure 7. *Stock Price and Exchange Rate, Jan. 2012-Dec. 2016*

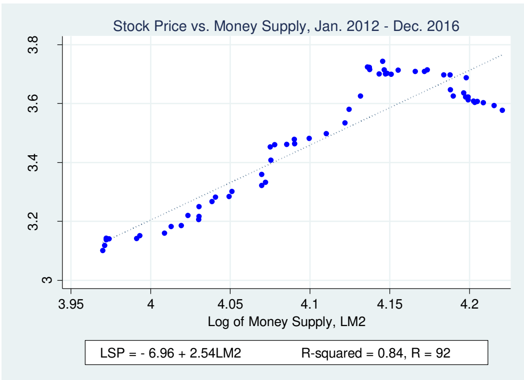


Figure 8. *Stock Price and Money Supply, Jan. 2012-Dec. 2016*

4.3. Unit Root Test results

Table 1A in the appendices, presents the results of the ADF tests both in levels and in first differences. As has been discussed, the ADF hypotheses are

$H_0 : \rho = 1$ Unit root i.e. a variable is non stationary

$H_0 : \rho < 1$ No unit root i.e. a variable is stationary

Results of the ADF unit root tests in levels which contain constant and constant & trend show that the test statistics for all the variables, in absolute terms, are lower than the critical values at 5 percent level of significance. In this case, the null hypothesis that a variable has a unit root or is non stationary cannot be rejected and it is therefore concluded that all the variables to be included in a series of models are non-stationary. After taking their first differences however, the variables become stationary. Here, as shown in Appendix Table 1A, the test statistics of all the variables, in absolute terms, are greater than the critical values at 5 percent, rejecting the null hypothesis of non stationarity. Overall conclusion at this early stage of estimations is that all variables should be integrated of order one to make them stationary. This implies that there is a need to take the first difference of those variables before they can be run in the regression model.

4.4. Results of cointegration tests: Johansen Test for cointegration

The results for testing the number of cointegrating relations for the 11 models, using Johansen test for cointegration, are reported in Appendix Tables 2A-12A. The first column is the number of cointegrating relations under the null hypothesis, the second column is the ordered eigenvalues of the Π matrix, the third column is the test statistic, and the last two columns are the 5 percent critical and probability values. The critical values are taken from MacKinnon-Haug-Michelis (1999). Trace statistic is used to determine the presence of co-integration between variables. On the basis of the trace statistic value test, the null hypothesis of no cointegration $(r = 0)$ is rejected at the 5 percent level of significance in favour of the specific alternative, namely that there is at most 1 cointegrating vector, for all the models except models 6 and 9. In models 6 and 9, results show that there are at most 2 cointegrating equations at the 5 percent level. The implication is that a linear combination of all the series for all models is found to be stationary and that there is a stable long-run relationship between the series.

4.5. Baseline Regression Analysis: Error Correction Model Results

In order to capture the short run relationship between the overall stock price and individual company's stock prices and a series of explanatory variables, the error correction model is estimated.[1] The error correction specification restricts the long run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing a wide range of short run dynamics. The error correction terms, ECT , are obtained from the solved static long run equations and lagged once, i.e. ECT_{t-1}. Accordingly, the stock price equations are specified to include the error correction model and the estimation results for the overall stock prices (Model 1) are presented in Table 3 while regression results for individual company's stock prices (Models 2-11) are reported in Table 4. All the models seem to be correct as the coefficient on the error correction term is negative and statistically significant. The ECT_{t-1} reflects the attempt to correct deviations from the long run equilibrium path and its coefficient can be interpreted as the speed of adjustment.

In model 1, the sign of the error correction coefficient in determination of overall stock price is negative and statistically significant indicating that stock prices do respond significantly to re-establish the equilibrium relationship once

[1] According to Angle and Granger (1987), when cointegration is established the next step is to represent a short-run disequilibrium relationship of the variables using an ECT.

deviation occurs. The speed at which the average stock price adjusts in the absence of any shocks is approximately 77 percent per month. Equally important, the F-statistic value of 247.8 is proportionately large and it is significant at 1 percent level, rejecting the null hypotheses that the coefficients are jointly equal to zero. Similarly, R-squared value of 0.96 reveals that about 96 percent of the systematic variations in the stock prices are explained by the regressors in the equation. In general, the model is significantly explained by the regressors, hence acceptable in overall terms (residual diagnostic analysis is discussed in subsection 4.6). The *t* values and standard errors are presented to test for the significance of the coefficient estimates. The *p*-values indicate the level of significance.

Estimations from the variant of the baseline specification reported in Table 3 show that money supply (*LM2)* is an important determinant of the variations in the stock prices. The variable is significant at the 1 percent level. A plausible interpretation of these results is that an increase in money supply boosts stock returns. The results suggest that overall stock prices will increase by 37 percent if money supply increases by 1 percent. This is consistent with the previous evidence of a positive and significant linkage between money supply and stock price (see for example Mukherjee and Naka, 1995; Maysami *et al*., 2004; Talla, 2013; Ratanapakorn and Sharma, 2007; Ouma & Muriu, 2014).

In theory, an increase in money supply implies an increase in demand for money which in turn leads to an increase in the economic activity. Accordingly, an increase in economic activity implies higher cash flows, which causes stock prices to rise. Similarly, expansion of the economy following money stock growth leads to greater credit being available to firms to expand production and then increase sale resulting in increased earnings for firms. This results in better dividend payments for firms leading to an increase in the price of stocks.

Empirical results also suggest that there is a positive and significant relationship between exchange rate and stock prices over the period of study. The coefficient on exchange rate is positive and significant at 1 percent level of significance, suggesting that a depreciation of the Tanzanian shilling may attract more foreign investments to invest in the Dar es Salaam stock market. These results are consistent with (Evans, 2009) but contrary to Doong *et al.* (2005), Talla (2013) and Ouma & Muriu (2014). In fact, some studies such as Rad (2011) and Abraham (2011) suggest either weak or no relationship between stock prices and exchange rate. Nevertheless, the empirical evidence presented here is in consistent with most studies undertaken in the developing countries.

Furthermore, empirical results of model 1 show that Treasury bill rates have a negative effect on stock prices. This result implies that an increase in the interest rate or Treasury bills rate will cause the stock price to decrease. The negative relationship between these two variables is consistent with the findings of many previous studies including Mahmudul & Gazi (2009); Humpe & Macmillan (2007); Al-Sharkas (2004); Adam and Tweneboah (2008); Uddin and Alam (2007); Geetha, *et al.* (2011); Alshogeathri (2011). One possible explanation for this negative relationship is that investors would not consider the Dar es Salaam stock market when the interest rate is high; hence the money and capital markets in the economy are substitutable.

Table 3. *Error Correction Model Regression Results*
Dependent Variable: Average Stock Price

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-7.988	0.861	-9.279	0.000
Inflation, π	-0.001	0.004	-0.186	0.852
Exchange Rate, *LER*	1.346	0.326	4.125	0.000
Money Supply, *LM2*	3.796	0.389	9.749	0.000
Treasury Bill Rate, *TB*	-0.021	0.004	-5.270	0.000
ECT_{t-1}	-0.769	0.103	-7.486	0.000
R-squared	0.958	Durbin-Watson stat		1.785
F-statistic	247.76	Heteroskedasticity Test: ARCH		0.586
Prob(F-statistic)	0.000	Serial Correlation LM Test:		0.663
Ramsey RESET Test	0.617			

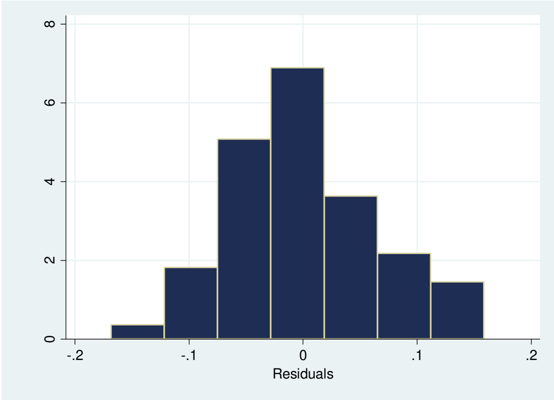
The coefficient on inflation rate is insignificant. Here the expectation was that inflation rate has a negative effect on stock price as it has been found in many studies including Reddy (2012); Bordo *et al.* (2008); Lintner (1973); Fama & Schwert (1977); Jaffe & Mandelker (1976); Geetha, *et al.,* (2011). These results however, are unsurprising; Gjerdea & Sættemb (1999) and Chen, *et al.,* (1986) also show that the relationship between stock prices and inflation is insignificant. Indeed, some studies for example Firth (1979); Maysami *et al.*, (2004) and Ratanapakorn and Sharma, (2007) show that the relationship between stock prices and inflation is positive implying that that equities serve as a hedge against inflation. The argument that the stock market serves as a hedge against inflation is based on the fundamental idea of Fisher (1930), and is known as the Fisher Effect. Nonetheless, lack of significant relationship between overall stock prices and inflation rate, in the current study may be due to the fact that the paper uses average stock prices of 10 companies whose behavior as far as changes in inflation rate are concerned may be different. We show, in the individual firm's stock prices regressions, that firm's stock prices respond negatively to increases in the rate of inflation (Table 4). The results of individual firms are discussed in subsection.

4.6. Residual diagnostic analysis of Model 1

To confirm and trust the *t*-test results from OLS regressions, the residuals should be white noise and that the model should be stable. Various diagnostic tests are used to assess the model. These include White Heteroskedasticity test, Breusch-Godfred LM test, ARCH LM test, Ramsey RESET and JB Normality test. The heteroskedasticity test is based on the null hypothesis of heteroskedasticity not present, LM test for autocorrelation up to order 1 is based on the null hypothesis that there is no autocorrelation; test for ARCH of order 1 is based on the null hypothesis that no ARCH effect is present, the Ramsey RESET test for specification is based on the null hypothesis of adequate specification, and test for normality of residuals is based on null hypothesis that the errors are normally distributed (see Epaphra 2016). These hypotheses can be summarized as follows

1	Serial correlation LM test	3	Serial correlation LM test
	H_0 : No autocorrelation		H_0 : Residuals are normally distributed
	H_1 : Autocorrelation		H_1 : Residuals are normally distributed
2	Heteroscedasticity test	4	Ramsey RESET test for specification
	H_0 : No heteroscedasticity		H_0 : Adequate specification
	H_1 : Heteroscedasticity		H_1 : Model misspecification

In view of these hypotheses, the diagnostic statistics of the residuals are quite impressive. As reported in Table 3, the estimated probability values of the chi-square tests for Breusch-Godfrey serial correlation LM test and heteroskedasticity test: ARCH are not significant at 5 percent level suggesting that the null hypotheses of no serial correlation and heteroscedasticity cannot be rejected. The implication here is that the model does not suffer from both serial autocorrelation and heteroscedasticity. Thus, OLS t-tests and F-statistic results are valid and so they can be trusted ipso facto. Moreover, the histogram and Jarque-Bera normality test as reported in Figure 9 suggest that the residuals of the model are normally distributed as we fail to reject the null hypothesis of normality using Jacque-Bera at 5 percent level of significance. To summarize, probability values of Portmanteau test for white noise and Barlett's periodogram-based white noise test, as Figure 10 reports, fail to reject the hypotheses that residuals are random or independent, there is no serial correlation among residuals and that residuals are stationary. Thus, as has been presented, residuals are normally distributed, they are not correlated and that their mean is zero.



Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Prob.
0.0671	0.3489	3.0993	1.2215	0.5429

Figure 9. *Normality Test of the Residuals*

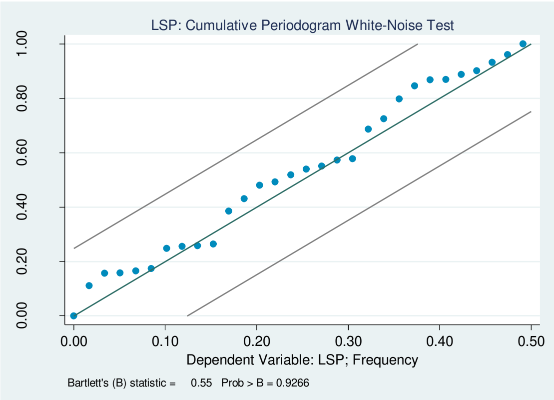


Figure 10. *White noise Test of the Residuals*

The probability value of Ramsey RESET test is also not significant at 5 percent level hence failing to reject the null hypothesis that the model is adequately specified. In addition, cumulative sum of recursive residuals (CUSUM) is used to test the stability of the models. In the use of the CUSUM plots, if the statistics stay within the critical bonds of 5 percent level of significance, the null hypothesis of all coefficients in the given regression are stable and cannot be rejected. The results of recursive estimated parameters are reported in Figure 11. Clearly, the Figure does not detect instability in the parameters of the model. Thus, using the CUSUM we fail to reject the null hypothesis of stability in the regression model. Residuals are within the standard errors bands. Hence, it can be concluded that the estimated regressors are stable throughout the observed period.

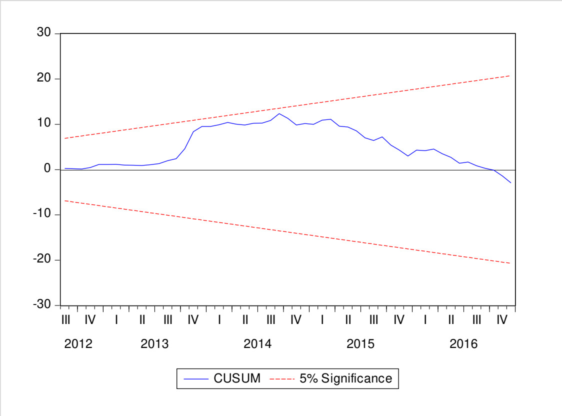


Figure 11. *Plot of Cumulative Sum of Recursive Residuals*

From the diagnostic checking results, we can conclude that residuals from our linear regression are white noise, meaning that they do not contain any systematic information and that the model is well specified.

4.7. Regression results for the individual company's: Models 2-11

The baseline regressions results for stock prices of individual firms are reported in Table 4. It is worth noting that the results of the regression analysis for the 10 firms are named as model 2-model 11 respectively. The Durbin Watson (DW) statistic is included in the results to test for auto-correlation in the error term. It should be understood that, as a rule of thumb, if DW is found to be 2 in an application one may conclude that there is no first order autocorrelation either positive or negative. Therefore, the closer DW is to 2, the greater the evidence of no serial correlation in the residuals. Similarly, the estimated probability values of the chi-square tests for Breusch-Godfrey serial correlation LM test is greater than 5 percent, hence failing to reject the null hypothesis across all models. Also, like in the overall stock price regression model, various diagnostic tests are used to assess the models. These include white heteroskedasticity ARCH LM test, Ramsey RESET test and JB Normality test. In view of these hypotheses, the regression models pass all specification tests. On the same importance, the F-statistic is significant at 1 percent level in all models, rejecting the null hypotheses that the coefficients are equal to zero. Similarly, R-squared is large in all models suggesting that macroeconomic variables included in the models explain a substantial proportion of the variations in the individual firms' stock prices. The *t* values and standard errors are presented to test for the significance of the coefficient estimates while the *p*-values indicate the level of significance.

Unlike in the regression of overall stock prices where inflation rate was found to be statistically insignificant, here results show that the coefficient on inflation rate is negative and significant at 1 percent level in all models except in models 8, 9 and 10. In models 8 and 10, although it is negative, it is weakly significant. In model 9, the coefficient on inflation is positive and statistically significant at 1 percent level. Many studies including Pal & Mittal (2011), Akbar *et al.,* (2012); Lintner (1973); Fama & Schwert (1977) also reveal a negative relationship between stock price and inflation rate. The inverse relationship between stock price and inflation supports the proxy effect of Fama (1981). Indeed, higher inflation raises the production cost which in turn adversely affects the profitability and the level of real economic activity. Since the real activity is positively associated with stock return, an increase in inflation reduces the stock price. Notwithstanding, the values of the coefficients on inflation rate are very small in spite of their levels of significance; again signifying the weak influence of inflation on variations in stock prices.

As it was expected the coefficient on money supply is positive and statistically significant in all models except models 4, 6, and 9 confirming the results obtained on overall stock prices regressions. Empirical results show that in models 2, 5, 7, 8, and 10 the coefficient on money supply is statistically significant at 1 percent level but in model 11, the coefficient is statistically significant at 5 percent level implying that individual company's stock prices respond positively to changes in money supply. However, some companies' stock prices either respond weakly or do not respond at all to any changes in money supply. For example, in models 4 and 9, results indicate that money supply does not have any impact on stock prices of the firms in consideration. Also, in model 3, results reveal that although the coefficient is positive as it was expected, it is weakly statistically significant suggesting that money supply has a little effect on stock price of the firm in question. Surprisingly, some firms seem to behave differently as far as changes in money supply are concerned. For example, in model 6, the coefficient on money supply is statistically significant at 1 percent level but negative. These results suggest that particularly firms' stock prices decline with an increase in money supply.

Table 4. Regression Results for the Individual Firms

	Model 2 LSP_TBL	Model 3 LSP_TOL	Model 4 LSP_TATEPA	Model 5 LSP_TCC	Model 6 LSP_TCCL	Model 7 LSP_SWISS	Model 8 LSP_TPCC	Model 9 LSP_DCB	Model 10 LSP_NMB	Model 11 LSP_CRDB
Inflation, π	-0.013*** (0.01) [-2.12]	-0.007** (0.00) [-2.79]	-0.027*** (0.00) [-14.00]	-0.012*** (0.01) [2.55]	-0.014*** (0.01) [-2.55]	-0.021*** (0.00) [-5.34]	-0.005* (0.00) [-1.54]	0.011*** (0.00) [3.40]	-0.008* (0.01) [-1.51]	-0.015*** (0.00) [-3.43]
Exchange rate, *LER*	2.229*** (0.52) [4.30]	0.393* (0.22) [1.79]	0.032 (0.16) [0.20]	1.469*** (0.37) [3.94]	-2.566*** (0.45) [-5.75]	1.825*** (0.33) [5.58]	1.110*** (0.28) [3.99]	-0.356 (0.27} [-1.33)	3.604*** (0.42) [8.53]	0.823** (0.37) [2.23]
Treasury bills, *TB*	-0.029*** (0.01) [4.72]	-0.004* (0.00) [-1.53]	-0.004** (0.00) [2.03]	-0.022 (0.01) [4.81]	0.025*** (0.01) [4.75]	-0.018*** (0.00) [-4.55]	0.019*** (0.00) [5.81]	0.021*** (0.00) [6.85]	-0.016*** (0.01) [3.18]	0.032*** (0.00) [7.24]
Money supply, *LM2*	6.505*** (0.62) [6.43]	2.971*** (0.26) [11.35]	0.093 (0.09) [0.49]	3.676*** (0.45) [8.24]	2.805*** (0.53) [5.34]	1.748*** (0.39) [4.54]	1.632*** (0.32) [4.99]	-0.831*** (0.32) [-2.63]	4.518*** (0.51) [8.87]	2.358*** (0.44) [5.39]
ECT_1	-0.705*** (0.11) [-6.43]	-0.561*** (0.12) [-4.63]	-0.711*** (0.10) [-7.15]	-0.777*** (0.10) [-7.62]	-0.856*** (0.08) [-10.51]	-0.745*** (0.10) [-7.24]	-0.831*** (0.08) [-10.15]	-0.886*** (0.32) [-2.63]	-0.718*** (0.11) [-6.87]	-0.778*** (0.09) [-8.59]
Constant	-16.04*** (0.12) [-11.79]	-10.958*** (0.57) [-19.27]	2.248*** (0.41) [5.95]	-6.531*** (0.49) [-6.58]	-0.176 (1.14) [-0.15]	-9.640*** (0.84) [-11.52]	0.085 (0.71) [0.12]	0.158 (0.68) [0.23]	-3.641*** (1.12) [-3.24]	-4.832*** (0.96) [-5.05]
Adj. R-squared	0.952	0.982	0.957	0.957	0.783	0.977	0.789	0.798	0.932	0.930
F-statistic	230.4	617.5	146.1	260.2	42.95	490.5	44.35	46.94	160.9	155.8
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Serial Correlation LM test	0.114	0.235	0.647	0.732	0.489	0.289	0.646	0.736	0.689	0.088
Heteroskedasticity test: ARCH	0.268	0.272	0.472	0.793	0.328	0.827	0.341	0.783	0.124	0.262
Ramsey RESET	0.430	0.061	0.975	0.297	0.522	0.636	0.562	0.575	0.067	0.634

Robust *t*-statistics are in blackets [.] ; standard errors are in parentheses (.); ***, **, * Indicate significance at 1%, 5% and 10% levels respectively.
Dependent variable: log of individual firm's stock price.

Source. Authors computations

Similar controversial results can be seen on the impact of exchange rate and Treasury bills rate on individual firms' stock prices. In models 2, 3, 7, 8, 10, and 11 the coefficient on exchange rate is positive and statistically significant either at 1 percent or at 5 percent level. This positive effect of exchange rate on individual firms' stock prices is consistent with the results obtained earlier in this paper. However, we reveal a negative and strong effect of exchange rate on individual firm's stock price in model 6. Likewise, in models 4 and 9, the coefficient on exchange rate is statistically insignificant implying that exchange rate exerts no influence on a particular firm's stock prices. Similar to overall stock prices regressions, the coefficients of exchange rate across models are substantial. May be the most controversial variable is Treasury bill rate. Results show that in models 2, 4, 5, 7, and 10, the coefficient on Treasury bill rate is negative and significant either at 1 percent or 5 percent levels. By contrast, the coefficient on the same variable in models 6, 8, 9, and 11, is positive and statistically significant at 1 percent level. In model 3, it negative but weakly statistically significant. In addition, the values of coefficient, in absolute terms, range from 0.004 in models 3 and 4 to 0.03 in model 11.

Interestingly, the adjustment parameter is negative across all models. Specifically, the ECM estimations reveal that between 56 percent (in model 3) and 86 percent (model 6) of the disequilibrium in individual firms' stock prices would be adjusted in every month. Thus, there is a stable relationship between the variables. Also, estimation results presented in Table 4 indicate that the F-statistic is significant at 1 percent across all models, rejecting the null hypothesis that all the regressors have coefficients not different from zero. Moreover, R-squared, which measures the goodness of fit of the variables, is sufficiently large; suggesting that between 78 percent (model 6) and 98 percent (model 3) of the variations in individual firms' stock prices is jointly explained by the regressors. In addition, we present the Correlogram Tests for each model that also confirm that the residual terms in the models are not serially correlated. The Correlogram tests are reported in appendix 3A.

On the basis of the above overall analysis, it can be concluded in general, money supply and exchange rate have a positive effect on stock prices. By contrast, Treasury bill rate affects stock prices negatively. We did not reveal any impact of inflation rate on overall stock prices, but many individual firms stock prices decline with an increase in inflation. More importantly, each individual firm's stock price seems to behave differently as far as changes in inflation, Treasury bill rate, exchange rate and money supply are concerned. Nonetheless, many firms' stock prices tend to increase with an increase money supply and exchange rate or depreciation of local currency and they tend to decrease with an increase inflation rate.

5. Conclusions and policy implications

The main objective of this paper was to investigate the impact of macroeconomic variables namely, inflation rate, treasury bill rate, exchange rate on stock prices in Tanzania. The paper used monthly time series that covering 10 firms listed on the Dar es Salaam Stock Exchange over the 2012:01-2016:12 period. The fact that some companies tend to behave differently, we specified 11 regression models. While model 1 examined the impact of the macroeconomic variables on overall stock price, the other 10 models explored the effect of the same macroeconomic variables on individual companies' stock prices. Unit Root or non stationarity was tested using ADF test while cointegration or long run relationship among the variables was examined using Johansen cointegration test. All variables were integrated of order one to make them stationary after failing to reject the null hypothesis of unit root or non stationary in level. For the long run analysis, the Johansen cointegration test suggested that macroeconomic variables in the system share a long run relationship indicating that each variable in the systems tends to adjust proportionally to bring in the system back to its long run equilibrium.

The Error Correction Mechanism was used for examining the effects of regressors on the regressand in all models. The models passed all specification tests including heteroscedasticity, autocorrelation or serial correlation, Ramsey RESET model specification, and JB Normality test. Similarly, F-test and R-squared were relatively large across all models, rejecting the null hypotheses that the coefficients on explanatory variables are jointly equal to zero and implying that the regressors do explain a substantial proportion in the systematic variations in the stock prices. The results of the main model showed that money supply and exchange have a positive effect on overall stock price, while Treasury bill rate tends to affect stock prices negatively. We did not find any evidence on the impact of inflation rate on overall stock prices. However, regression results on the influences of inflation on individual firm's stock prices are indeed mixed. Some firms' stock prices tend to decline with the increase in inflation rate, implying that for some firms, the Dar es Salaam stock market is not an effective hedge against inflation; hence investments probably would shift to the real assets from a risky stock market when the inflation rate is very high. However, other firms' stock prices tend to be affected positively by inflation. Similar controversial relationships could be seen between individual firm's stock prices and Treasury bill rate, exchange rate and money supply. However, among the four macroeconomic variables, money supply is found to be the major determinant of stock price index in Tanzania. It is worth noting that the mixed results on the relationship between stock prices and macroeconomic variables among the firms listed on the Dare es Salaam Stock Exchange would imply different behavior of these firms as variations in money supply, exchange rate, money supply and Treasury bill rate are concerned.

The results of this paper have some important policy implications that can be useful to both private and public sectors. It was observed that the money supply is the major determinant of the stock price, so the regulatory body should continue to control the repo and reserve repo rates. Similarly, although we did not find any significant impact of inflation on overall stock price, inflation actually was found to have a negative impact on many individual firms' stock prices which were included in the regression analysis. The fact that inflation implies economic instability, stable economy is likely to improve the stock price and make it grow significantly over time. Inflation too, can be controlled through repo and reserve repo rates. Notably, many investors tend to maximize returns if they buy during a downturn in the economy and sell during a boom. This kind of behaviour also may strengthen the stabilization of the stock market in the economy. Also, exchange rate and Treasury bill rate have some important information that can help in predictions of the stock market performance. Considering the importance of the stock market as a channel for monetary policy transmission, Dar es Salaam Stock Exchange, Capital Markets and Securities Authorities and Bank of Tanzania under their authority should enforce the laws and regulations that aiming at stabilizing interest rate and exchange rate, which in turn stabilize the performance of stock market.

As has been presented and discussed, the macroeconomic variables tend to affect stock prices positively or negatively. However, the limitations of the paper should not be over looked. Specifically, inclusion of more variables with a longer time period may improve the results. A logical extension of the study can be done by including more regressors in the model. Likewise, regression analysis may take a sector wise stock index. Panel data models such as generalized method of moments (GMM), fixed effects model (FE), and random effect (RE) model may be used rather than time series models. Equally important, an extension of study period from 60 months to 120 months, and number companies included in the analysis may also improve the results and policy implications.

Appendices

Table 1A. *Results of the ADF Unit Root Tests: Levels and First Difference*

	Levels		First Difference, Δ	
Optimal Lag = 1	Constant $\psi_1 = 0$	Constant and Trend $\psi_1 = \psi_2 = 0$	Constant $\psi_1 = 0$	Constant & Trend $\psi_1 = \psi_2 = 0$
LSP	-1.763	-0.136	-4.383	-4.881
LSP_TBL	-1.353	-0.821	-4.618	-4.756
LSP_TOL	-0.866	-1.858	-6.935	-6.913
LSP_TATEPA	-3.308	-1.628	-7.361	-8.221
LSP_TCC	-2.175	0.110	-7.009	-7.897
LSP_TCCL	-0.781	-0.795	-6.354	-6.463
LSP_SWISS	-2.225	-0.234	-6.404	-6.900
LSP_TPCC	-1.683	-1.268	-6.493	-6.641
LSP_DCB	-1.142	-1.321	-6.711	-6.693
LSP_NMB	-1.730	-0.995	-6.824	-7.021
LSP_CRDB	-1.358	-0.367	-6.289	-6.455
π	-3.576	-2.235	-4.337	-5.277
LER	-0.186	-1.863	-2.691	-4.140
TB	-1.425	-2.417	-6.624	-10.10
LM2	-1.147	-2.040	-8.995	-9.105
5% Critical Value	-2.913	-3.489	-2.913	-3.173

Notes: Null Hypothesis: *there is a unit root*

Table 2A. *Johansen Tests for Cointegration*

Model 1: Series: LSP, π , TB, LER, LM2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.458814	79.80547	69.81889	0.0064
At most 1	0.314862	44.19394	47.85613	0.1060
At most 2	0.187096	22.26212	29.79707	0.2842
At most 3	0.122075	10.24786	15.49471	0.2621
At most 4	0.045428	2.696571	3.841466	0.1006

Notes: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values.

Table 3A. *Johansen Tests for Cointegration*

Model 2: Series: LSP_TBL, π , TB, LER, LM2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.461596	72.05203	69.81889	0.0328
At most 1	0.253437	36.14160	47.85613	0.3892
At most 2	0.152162	19.18960	29.79707	0.4794
At most 3	0.108443	9.615757	15.49471	0.3115
At most 4	0.049725	2.958194	3.841466	0.0854

Notes: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values

Table 4A. *Johansen Tests for Cointegration*

Model 3: Series: LSP_TOL, π , TB, LER, LM2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.449096	81.30721	76.97277	0.0225
At most 1	0.341983	46.72794	54.07904	0.1918
At most 2	0.181174	22.45354	35.19275	0.5649
At most 3	0.112106	10.86028	20.26184	0.5556
At most 4	0.066060	3.963906	9.164546	0.4175

Notes: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values.

Table 5A. *Johansen Tests for Cointegration*

Model 4: Series: LSP_TATEPA, π , TB, LER, LM2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.397536	77.11609	76.97277	0.0488
At most 1	0.314661	47.72594	54.07904	0.1632
At most 2	0.209667	25.81116	35.19275	0.3525
At most 3	0.134331	12.16369	20.26184	0.4343
At most 4	0.063369	3.797003	9.164546	0.4432

Notes: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values.

Table 6A. *Johansen Tests for Cointegration*
Model 5: Series: LSP_TCC, π , TB, LER, LM2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.489458	83.94882	69.81889	0.0025
At most 1	0.323655	44.95645	47.85613	0.0913
At most 2	0.197800	22.27543	29.79707	0.2835
At most 3	0.109938	9.492369	15.49471	0.3218
At most 4	0.046101	2.737441	3.841466	0.0980

Notes: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values.

Table 7A. *Johansen Tests for Cointegration*
Model 6: Series: LSP_TCCL, π , TB, LER, LM2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.458329	92.38507	76.97277	0.0021
At most 1 *	0.336912	56.82550	54.07904	0.0279
At most 2	0.241817	32.99631	35.19275	0.0847
At most 3	0.154028	16.94011	20.26184	0.1348
At most 4	0.117329	7.238536	9.164546	0.1144

Notes: Trace test indicates 2 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values.

Table 8A. *Johansen Tests for Cointegration*
Model 7: Series: LSP_SWISS, π , TB, LER, LM2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.535493	89.56683	69.81889	0.0006
At most 1	0.327143	45.09368	47.85613	0.0888
At most 2	0.206907	22.11275	29.79707	0.2923
At most 3	0.103089	8.667458	15.49471	0.3970
At most 4	0.039825	2.357121	3.841466	0.1247

Notes: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values.

Table 9A. *Johansen Tests for Cointegration*
Model 8: Series: LSP_TPCC, π , TB, LER, LM2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.497634	83.10346	69.81889	0.0030
At most 1	0.310508	43.17474	47.85613	0.1284
At most 2	0.163124	21.61034	29.79707	0.3207
At most 3	0.144810	11.28176	15.49471	0.1947
At most 4	0.037366	2.208743	3.841466	0.1372

Notes: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values.

Table 10A. *Johansen Tests for Cointegration*
Model 9: Series: LSP_DCB, π , TB, LER, LM2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.371665	76.52173	69.81889	0.0132
At most 1 *	0.340120	49.57016	47.85613	0.0342
At most 2	0.241311	25.45970	29.79707	0.1457
At most 3	0.122411	9.442259	15.49471	0.3260
At most 4	0.031707	1.868803	3.841466	0.1716

Notes: Trace test indicates 2 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values.

Table 11A. *Johansen Tests for Cointegration*
Model 10: Series: LSP_NMB, π , TB, LER, LM2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.450509	71.94675	69.81889	0.0335
At most 1	0.292662	37.21847	47.85613	0.3373
At most 2	0.164985	17.13618	29.79707	0.6300
At most 3	0.059160	6.678474	15.49471	0.6153
At most 4	0.052723	3.141495	3.841466	0.0763

Notes: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values.

Table 12A. *Johansen Tests for Cointegration*

Model 11: Series: LSP_CRDB, π , TB, LER, LM2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.427777	78.50066	76.97277	0.0381
At most 1	0.358947	46.12355	54.07904	0.2108
At most 2	0.140156	20.33428	35.19275	0.7056
At most 3	0.108654	11.57601	20.26184	0.4875
At most 4	0.081087	4.904709	9.164546	0.2940

Notes: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values.

Appendix 3A: Correlogram Tests for Models 2-11

	LSP_TBL, Model 2			
	AC	PAC	Q-Stat	Prob
1	0.072	0.072	0.3226	0.570
2	0.011	0.006	0.3298	0.848
3	0.102	0.102	1.0019	0.801
4	0.008	-0.007	1.0058	0.909
5	0.088	0.089	1.5262	0.910
6	0.314	0.298	8.2243	0.222
7	-0.050	-0.096	8.3976	0.299
8	-0.038	-0.049	8.4969	0.386
9	0.073	0.030	8.8767	0.449
10	-0.001	-0.001	8.8767	0.544
11	0.088	0.052	9.4543	0.580
12	0.128	0.033	10.714	0.554
13	-0.068	-0.035	11.081	0.604
14	-0.167	-0.179	13.308	0.502
15	-0.197	-0.260	16.470	0.351
16	-0.111	-0.104	17.497	0.354
17	-0.169	-0.231	19.948	0.277
18	0.023	0.027	19.994	0.333
19	-0.080	0.002	20.571	0.361
20	-0.149	-0.001	22.619	0.308

	LSP_TOL, Model 3			
	AC	PAC	Q-Stat	Prob
1	0.131	0.131	1.0639	0.302
2	0.045	0.028	1.1907	0.551
3	-0.021	-0.031	1.2201	0.748
4	-0.032	-0.027	1.2869	0.864
5	0.003	0.013	1.2877	0.936
6	0.162	0.165	3.0657	0.801
7	-0.080	-0.129	3.5070	0.834
8	-0.051	-0.040	3.6905	0.884
9	0.070	0.107	4.0408	0.909
10	0.129	0.125	5.2576	0.873
11	0.085	0.033	5.7965	0.887
12	-0.001	-0.067	5.7966	0.926
13	-0.019	0.033	5.8241	0.952
14	-0.182	-0.170	8.4793	0.863
15	-0.151	-0.159	10.350	0.797
16	-0.009	0.018	10.357	0.847
17	-0.209	-0.215	14.114	0.659
18	0.011	0.082	14.125	0.721
19	0.001	-0.027	14.125	0.776
20	-0.078	-0.067	14.688	0.794

Notes: The test for serial correlation using Correlogram indicates that there is no serial correlation in the model. None of the lag is found to be significant at 5 percent level. Source: Authors Computations.

	LSP_TATEPA, Model 4			
	AC	PAC	Q-Stat	Prob
1	0.074	0.074	0.3370	0.562
2	-0.101	-0.107	0.9843	0.611
3	0.141	0.160	2.2574	0.521
4	-0.167	-0.214	4.0766	0.396
5	-0.039	0.041	4.1802	0.524
6	0.066	-0.006	4.4788	0.612
7	-0.303	-0.275	10.818	0.147
8	-0.069	-0.019	11.155	0.193
9	-0.072	-0.179	11.526	0.241
10	-0.190	-0.097	14.182	0.165
11	0.137	0.062	15.589	0.157
12	-0.039	-0.140	15.705	0.205
13	-0.008	0.086	15.710	0.265
14	0.189	-0.004	18.581	0.182
15	0.058	0.081	18.858	0.220
16	0.070	0.029	19.267	0.255
17	-0.044	-0.217	19.435	0.304
18	-0.092	0.044	20.171	0.323
19	-0.013	-0.149	20.186	0.383
20	-0.100	-0.079	21.114	0.390

	LSP_TCC, Model 5			
	AC	PAC	Q-Stat	Prob
1	-0.036	-0.036	0.0819	0.775
2	0.094	0.093	0.6457	0.724
3	0.238	0.247	4.2728	0.633
4	-0.058	-0.049	4.4954	0.643
5	0.102	0.053	5.1915	0.393
6	0.344	0.328	13.224	0.060
7	-0.055	-0.016	13.436	0.062
8	-0.049	-0.192	13.607	0.093
9	0.145	0.026	15.122	0.088
10	-0.066	0.034	15.439	0.117
11	-0.023	-0.096	15.479	0.162
12	0.248	0.121	20.201	0.063
13	-0.152	-0.054	22.012	0.055
14	-0.105	-0.131	22.895	0.062
15	-0.095	-0.260	23.634	0.072
16	-0.282	-0.247	30.289	0.057
17	-0.152	-0.170	32.271	0.054
18	0.072	0.040	32.722	0.058
19	-0.182	0.024	35.688	0.042
20	-0.104	0.053	36.678	0.057

Notes: The test for serial correlation using Correlogram indicates that there is no serial correlation in the model. None of the lag is found to be significant at 5 percent level. Source: Authors Computations.

	LSP_TCCL, Model 6			
	AC	PAC	Q-Stat	Prob
1	0.053	0.053	0.1771	0.674
2	-0.139	-0.142	1.3957	0.498
3	0.046	0.064	1.5315	0.675
4	-0.003	-0.030	1.5319	0.821
5	0.109	0.131	2.3286	0.802
6	0.227	0.211	5.8176	0.444
7	0.087	0.107	6.3445	0.500
8	0.024	0.076	6.3859	0.604
9	-0.098	-0.104	7.0760	0.629
10	-0.144	-0.164	8.5950	0.571
11	0.188	0.121	11.253	0.422
12	0.062	-0.057	11.548	0.483
13	-0.016	0.004	11.568	0.563
14	-0.189	-0.245	14.436	0.418
15	-0.244	-0.213	19.317	0.200
16	-0.033	-0.055	19.409	0.248
17	-0.110	-0.233	20.454	0.252
18	0.060	0.082	20.771	0.291
19	-0.050	-0.127	20.994	0.337
20	-0.211	-0.052	25.087	0.198

	LSP_SWISS, Model 7			
	AC	PAC	Q-Stat	Prob
1	0.094	0.094	0.5498	0.458
2	-0.173	-0.183	2.4365	0.296
3	0.154	0.199	3.9673	0.265
4	-0.018	-0.103	3.9881	0.408
5	0.128	0.234	5.0870	0.405
6	0.243	0.146	9.0936	0.168
7	-0.128	-0.109	10.228	0.176
8	-0.087	-0.032	10.767	0.215
9	0.148	0.065	12.344	0.195
10	-0.111	-0.155	13.249	0.210
11	0.054	0.110	13.470	0.264
12	0.143	0.021	15.039	0.239
13	-0.119	-0.002	16.147	0.241
14	-0.129	-0.156	17.477	0.232
15	-0.140	-0.206	19.075	0.210
16	-0.101	-0.035	19.929	0.223
17	-0.068	-0.187	20.327	0.258
18	-0.032	-0.002	20.414	0.310
19	-0.067	0.038	20.820	0.347
20	-0.174	-0.124	23.624	0.259

Notes: The test for serial correlation using Correlogram indicates that there is no serial correlation in the model. None of the lag is found to be significant at 5 percent level. Source: Authors Computations.

	LSP_TPCC, Model 8			
	AC	PAC	Q-Stat	Prob
1	0.088	0.088	0.4795	0.489
2	-0.085	-0.094	0.9374	0.626
3	-0.125	-0.110	1.9341	0.586
4	-0.191	-0.183	4.3336	0.363
5	0.294	0.322	10.088	0.073
6	0.214	0.132	13.212	0.040
7	0.008	-0.022	13.216	0.067
8	-0.090	-0.064	13.794	0.087
9	-0.052	0.126	13.990	0.123
10	-0.056	-0.110	14.219	0.163
11	0.109	0.010	15.109	0.178
12	0.102	0.045	15.910	0.195
13	-0.084	-0.049	16.460	0.225
14	-0.264	-0.337	22.015	0.078
15	-0.159	-0.064	24.075	0.064
16	-0.111	-0.137	25.109	0.068
17	0.058	-0.073	25.400	0.086
18	0.081	-0.082	25.983	0.100
19	-0.064	0.115	26.352	0.121
20	-0.081	0.001	26.962	0.136

	LSP_DCB, Model 9			
	AC	PAC	Q-Stat	Prob
1	0.036	0.036	0.0793	0.778
2	-0.095	-0.097	0.6534	0.721
3	-0.044	-0.037	0.7790	0.854
4	0.089	0.084	1.2942	0.862
5	-0.145	-0.162	2.6876	0.748
6	-0.120	-0.097	3.6725	0.721
7	-0.065	-0.080	3.9679	0.783
8	0.041	0.004	4.0882	0.849
9	-0.068	-0.073	4.4203	0.882
10	-0.155	-0.171	6.1920	0.799
11	-0.128	-0.168	7.4147	0.765
12	0.125	0.054	8.6061	0.736
13	0.106	0.060	9.4771	0.736
14	0.245	0.271	14.265	0.430
15	-0.064	-0.099	14.599	0.481
16	-0.027	-0.091	14.662	0.550
17	0.073	0.058	15.116	0.587
18	0.109	0.122	16.166	0.581
19	-0.345	-0.282	26.854	0.108
20	-0.126	-0.145	28.326	0.102

Notes: The test for serial correlation using Correlogram indicates that there is no serial correlation in the model. None of the lag is found to be significant at 5 percent level. Source: Authors Computations.

	LSP_NMB, Model 10			
	AC	PAC	Q-Stat	Prob
1	0.043	0.043	0.1155	0.734
2	-0.101	-0.103	0.7537	0.686
3	-0.010	-0.001	0.7608	0.859
4	0.317	0.311	7.3428	0.119
5	-0.035	-0.073	7.4223	0.191
6	0.044	0.117	7.5564	0.272
7	0.041	0.034	7.6739	0.362
8	0.055	-0.043	7.8885	0.444
9	-0.094	-0.056	8.5257	0.482
10	0.028	-0.013	8.5816	0.572
11	0.095	0.072	9.2538	0.598
12	-0.113	-0.154	10.231	0.596
13	-0.122	-0.049	11.396	0.578
14	0.038	0.016	11.509	0.646
15	-0.055	-0.144	11.753	0.698
16	-0.147	-0.049	13.566	0.631
17	-0.091	-0.073	14.274	0.648
18	-0.010	-0.045	14.282	0.711
19	-0.059	-0.001	14.597	0.748
20	-0.159	-0.116	16.940	0.657

	LSP_CRDB, Model 11			
	AC	PAC	Q-Stat	Prob
1	0.222	0.222	3.0574	0.080
2	-0.125	-0.183	4.0437	0.132
3	-0.128	-0.059	5.0968	0.165
4	-0.001	0.026	5.0968	0.278
5	0.114	0.086	5.9557	0.311
6	-0.006	-0.066	5.9579	0.428
7	0.004	0.055	5.9591	0.545
8	-0.171	-0.194	8.0185	0.432
9	-0.109	-0.023	8.8768	0.449
10	0.065	0.054	9.1864	0.515
11	0.236	0.193	13.353	0.271
12	-0.044	-0.185	13.499	0.334
13	-0.247	-0.112	18.290	0.147
14	-0.105	-0.018	19.169	0.159
15	0.013	-0.013	19.183	0.206
16	0.275	0.229	25.534	0.061
17	0.059	-0.063	25.830	0.078
18	-0.120	-0.091	27.093	0.077
19	-0.171	-0.064	29.737	0.055
20	-0.158	-0.128	32.027	0.043

Notes: The test for serial correlation using Correlogram indicates that there is no serial correlation in the model. None of the lag is found to be significant at 5 percent level. Source: Authors Computations.

References

Abraham, T.W. (2011). Stock market reaction to selected macroeconomic variables in the Nigerian economy. *CBN Journal of Applied Statistics*, 2(1), 61-70.

Adam, A.M., & Tweneboah, G. (2008). Macroeconomic factors and stock market movement: Evidence from Ghana. Munich Personal RePEc Archive, *MPRA Paper*, No.11256.

Aggarwal, R. (1981). Exchange rates and stock prices: A study of the US capital markets under floating exchange rates. *Akron Business and Economic Review*, 12, 7-12.

Akbar, M., Ali, S., & Khan, M.F. (2012). The relationship of stock prices and macroeconomic variables revisited: Evidence from Karachi Stock Exchange, *African Journal of Business Management*, 6(4), 1315-1322.

Alam, M. & Uddin, G.S. (2009). Relationship between interest rate and stock price: Empirical evidence from developed and developing countries. *International Journal of Business and Management,* 4(3), 43-51. doi. 10.5539/ijbm.v4n3p43

Ali, M. (2011). Impact of micro and macroeconomic variables on emerging stock market return: A case on Dhaka stock exchange (DSE). *Interdisciplinary Journal of Research in Business,* 1(5), 8-16.

AL-Sharkas, A. (2004). The dynamic relationship between macroeconomic factors and the Jordanian Stock Market. *International Journal of Applied Econometrics and Quantitative Studies*, 1(1), 97-114.

Alshogearthi, M. (2011). Macroeconomic determinant of the stock market movement: empirical evidence from the Saudi stock market. Ph.D. Dissertation, Kansas State University.

Benigno, A.M. (2016). Relationships between interest rate changes and stock returns: International evidence using a quantile-on-quantile approach. Master en Banca y Finanzas Cuantitativas, Trabajo de investigación 001/016, Universidad Complutense de Madrid.

Bhattacharya, B., & Mookherjee, J. (2001). *Causal relationship between and exchange rate, foreign exchange reserves, value of trade balance and stock market: Case study of India.* Working Paper, Jadavpur University Department of Economics, Kolkata, India. [Retrieved from].

Bordo, M.D., Dueker, M.J., & Wheelock, D.C. (2008). Inflation, monetary policy and stock market conditions: Quantitative evidence from a hybrid latent-variable VAR. Federal Reserve Bank of St. Louis Working Paper Series, Working Paper, No.2008-012B. [Retrieved from].

Brooks, C. (2008). *Introductory econometrics for finance.* 2nd Edition, Cambridge University Press, New York. doi. 10.1017/CBO9780511841644

Chen, N-F., Roll, R., & Ross, A.S. (1986). Economic forces and the stock market. *Journal of Business*, 59(3), 383-403. jstor.org/stable/2352710

Dinenis, E., & Staikouras, S.K. (1998). Interest rate changes and common stock returns of financial institutions: evidence from the UK, *European Journal of Finance*, 4(2), 113-127. doi. 10.1080/135184798337344.

Dong, M., Robinson, C., & Veld, C. (2005). Why individual investors want dividends. *Journal of Corporate Finance*, 12(1), 121-158. doi. 10.1016/j.jcorpfin.2004.04.006

Doong, S.-Ch., Yang, Sh.-Y., & Wang, A., (2005). The dynamic relationship and pricing of stocks and exchange rates: Empirical evidence from Asian emerging markets. *The Journal of American Academy of Business*, *Cambridge*, 7(1), 118-123.

Engle, R., & Granger, C. (1987). Co-Integration and error correction: representation, estimation, and testing. *Econometrica,* 55(2), 251-276. doi. 10.2307/1913236

Epaphra, M. (2016). Foreign direct investment and sectoral performance in Tanzania. *Journal of Economics and Political Economy*, 3(4), 670-719. doi. 10.1453/jepe.v3i4.1113

Fama, E.F. & Schwert, G.W. (1977). Asset returns and inflation. *Journal of Financial Economics,* 5(2), 115-146. doi. 10.1016/0304-405X(77)90014-9

Fama, E. F. (1981). Stock returns, real Activity, inflation and money. *American Economic Review*, 71(4), 545-565.

Firth, M. (1979). The relationship between stock market returns and rates of inflation. *The Journal of Finance,* 34(3). doi. 10.1111/j.1540-6261.1979.tb02139.x.

Fisher, I. (1930). *The Theory of Interest.* New York: Macmillan

Flannery, M.J., & James, C.M. (1984). The effect of interest rate changes on the common stock returns of financial institutions. *Journal of Finance,* 39(4), 1141-1153. doi. 10.1111/j.1540-6261.1984.tb03898.x

Geetha, C., Mohidin, R., Chandran, V., & Chong, V. (2011).The relationship between inflation and stock market: Evidence from Malaysia, United States and China. *International Journal of Economics and Management Sciences,* 1(2), 1-16.

Gjerdea, Ø. & Sættemb, F. (1999). Causal relations among stock returns and macroeconomic variables in a small, open economy. *Journal of International Financial Markets, Institutions & Money*, 9(1), 61-74. doi. 10.1016/S1042-4431(98)00036-5.

Hamburger, M.J., & Kochin, L.A. (1972). Money and stock prices: The channels of influences. *The Journal of Finance*, 27(2), 231-249. doi. 10.2307/2978472.

Hjalmarsson, E., & Österholm, P. (2007). Testing for cointegration using the Johansen methodology when variables are near-integrated, IMF *Working Paper,* No.07/141.

Homa, K.E., & Jaffee, D.M. (1971). The supply of money and common stock prices. *The Journal of Finance*, 26(5), 1045-1066. doi. 10.2307/2326082.

Horobet, A., & Dumitrescu, S. (2009). On the causal relationship between stock prices and exchange rates: evidence from Romania. [Retrieved from].

Humpe, A., & Macmillan, P. (2007). Can macroeconomic variables explain long term stock market movements? A comparison of the US and Japan. *Centre for Dynamic Macroeconomic Analysis*, CDMA Working Paper, No. 07/20.

Ibrahim, M.H., & Aziz, H. (2003). Macroeconomic variables and the malaysian equity market: A view through rolling subsamples. *Journal of Economic Studies*, 30(1), 6-27. doi. 10.1108/01443580310455241

Jaffe, J.F., & Mandelker, G. (1976). The 'Fisher effect' for risky assets: An empirical investigation. *The Journal of Finance*, 31(2), 447-458. doi. 10.2307/2326616

Johansen, S., & Juselius, K. (1988). Hypothesis testing for cointegration vectors with an application to the demand for money in Denmark and Finland. University of Copenhagen, *Working Paper*, No.88-05. [Retrieved from].

Khan, K. (2012). Effect of dividends on stock prices: A case of chemical and pharmaceutical industry of Pakistan. Proceedings of 2nd International Conference on Business Management.

Kurihara, Y. (2006). The relationship between exchange rate and stock prices during the quantitative easing policy in Japan. *International Journal of Business*, 11(4), 375-386.

Kyereboah-Coleman, A., & Agyire-Tettey, K.F. (2008). Impact of macroeconomic indicators on stock market performance: The case of the Ghana Stock Exchange. *The Journal of Risk Finance*, 9(4), 365-378. doi. 10.1108/15265940810895025

Lintner, J. (1973). Inflation and common stock prices in a cyclical context. National Bureau of Economic Research, Annual Report, p. 23-36.

Lynge, M.J., & Zumwalt, J.J. (1980). An empirical study of the interest rate sensitivity of commercial bank returns: A multi-index approach. *Journal of Financial and Quantitative Analysis*, 15(3), 731-742. doi. 10.2307/2330406

MacKinnon, J., Haug, G., & Michelis, L. (1999). Numerical distribution functions of likelihood ratio tests for cointegration. *Journal of Applied Econometrics*, 14(5), 563-577. doi. 10.1002/(SICI)1099-1255(199909/10)14:5<563::AID-JAE530>3.0.CO;2-R.

Mahmudul, A., & Gazi, S.U. (2009). The relationship between interest rate and stock price: Empirical evidence from developed and developing countries. *International Journal of Business and Management*, 4(3), 43-51.

Maysami, R., Howe, L., & Hamzah, M. (2004). Relationship between macroeconomic variables and stock market indices: Cointegration evidence from stock exchange of Singapore's all-S sector indices. *Journal Pengurusan*, 24(1), 47-77.

Mohammad, S., Hussain, A., Jalil, M., & Ali, A. (2009). Impact of macroeconomic variables on stock prices: Empirical evidence in case of KSE (Karachi Stock Exchange). *European Journal of Scientific Research*, 38(1), 96-103.

Mukherjee, T., & Naka, A. (1995). Dynamic relation between macroeconomic variables and the Japanese stock market: An application of a Vector Error Correction model. *Journal of Financial Research*, 18(2), 223-237. doi. 10.1111/j.1475-6803.1995.tb00563.x

Muktadir-al-Mukit, D. (2012). Effects of interest rate and exchange rate on volatility of market index at Dhaka stock exchange. *Journal of Business and Technology*, 7(2), 1-18.

Ouma, W.N., & Muriu, P. (2014). The impact of macroeconomic variables on stock market returns in Kenya. *International Journal of Business and Commerce*, 3(11), 1-31.

Pal, K., & Mittal, R. (2011). The impact of macroeconomic indicators on Indian capital markets. *Journal of Risk Finance*,12(2), 84-97. doi. 10.1108/15265941111112811

Prasad, A.M., & Rajan, M. (1995). The role of exchange and interest risk in equity valuation: A comparative study of international stock markets. *Journal of Economics and Business*, 47(5), 457-472. doi. 10.1016/0148-6195(95)00038-0

Rad, A.A. (2011). Macroeconomic variables & stock market: Evidence from Iran. *International Journal of Economics and Finance Study*, 3(1), 1-10.

Rafique, A., Amara, A., & Sultana, N. (2014). Impact of macroeconomic variables on stock market index (a case of Pakistan). *Finance Management*, 57, 14099-14104.

Rahman, A.A., Noor, Z.M.S., & Fauziah, H.T. (2009). Macroeconomic determinants of Malaysian stock market. *African Journal of Business Management*, 3(3), 95-106.

Ratanapakorn, O., & Sharma, S.C. (2007). Dynamic analysis between the US stock returns and the macroeconomic variables. *Applied Financial Economics*, 17(5), 369-377. doi. 10.1080/09603100600638944

Reddy, D.V.L. (2012). Impact of inflation and GDP on stock Market returns in India. *International Journal of Advanced Research in Management and Social Sciences*, 1(6), 120-136.

Singh, T., Mehta, S., & Varsha, M. (2011). Macroeconomic factors and stock return: Evidence from Taiwan. *Journal of Economics and International Finance*, 2(4), 217-227.

Sweeney , R.J., & Warga, A.D. (1986).The Pricing of Interest-Rate Risk: Evidence from the Stock Market. *The Journal of Finance*, 41(2), 393-410. doi. 10.1111/j.1540-6261.1986.tb05044.x

Talla, J. (2013). *Impact of macroeconomic variables on the stock market prices of the Stockholm stock exchange (OMXS30)*.JÖNKÖPING UNIVERSITY: Sweden. Master of Science Thesis.

Uddin, M.G.S., & Alam, M.M. (2007). The Impacts of interest rate on stock market: Empirical evidence from Dhaka stock exchange. *South Asian Journal of Management and Sciences*, 1(2), 123-132.

Ullah, F., Hussain, I., & Rauf, A. (2014). Impacts of macroeconomy on stock market: Evidence from Pakistan. *International Journal of Management and Sustainability*, 3(3), 140-146.

Wongbangpo, P. & Sharma, S. C. (2002). Stock market and macroeconomic fundamental dynamic interactions: ASEAN-5 countries. *Journal of Asian Economics*, 13(1) 27-51. doi. 10.1016/S1049-0078(01)00111-7