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RESEARCH ARTICLE

DETERMINANTS OF STOCK MARKET PRICE ON UGANDASECURITIES EXCHANGE

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Abstract

This study was undertaken to establish the determinants of stock market price on Uganda securities Exchange (USE) from January 2003 to March 2011.Using the Augmented Dickey Fuller and Phillip-Perron unit root tests, the underlying series were tested for stationarity. The Johansen-Juselius (1990) cointegration procedure was used to determine whether a cointegrating relationship exists between the macroeconomic variables and the stock market price. The time series of money supply, inflation, interest rate and the exchange rate were found to be stationary at first difference and had a significant influence on the stock market price. Further, the study revealed that money supply and exchange rate are significant determinants of stock market price in the long-run. While the lagged value of interest rate and money supply are insignificant in explaining the stock market pricein the short-run.

Introduction

The stock exchange of Uganda has been considered an emerging capital market (Wasake, 2012; Mbanga, 2008) since its inception in January 1998. Its market capitalization compared to the stock exchange of Kenya is small even though bond trading and other financial innovations have emerged in the last decade(Ratio Magazine, 2010). Like other emerging capital markets in East Africa, liberalization in Uganda's financial market, both money and capital markets has reduced the regulation for foreign investors. This financial liberalization included lifting capital control measures and allowing banks to lend and borrow more freely in both in-and-off-shore transactions (Kasekende & Atingi-Ego, 2003; Obwona, Abuka, & Egesa, 2006). In addition, the government of Uganda hasurged capital inflows in both portfolio and foreign direct investments. As a result, there has been a continuous increase in private investment via issuing new stocks[1]and the volume of stock trading has increased considerably during the recent years (USE Annual Report, 2010).

The Uganda Securities Exchange (USE) was founded in June 1997 under the supervision of the Capital Markets Authority, which in turn reports to the Bank of Uganda (Wikipedia, 2012). It opened doors to trading in January 1998 and trading was limited to only a handful of trades per week. The market has been growing in terms of both listed companies and activities (Wikipedia, 2012). The number of listed companies increased from four (4) in 2001 to thirteen (13) in 2010, while market capitalization increased from Ushs.61.0 billion in 2001 toUshs.12.8 trillion in 2010. During this period, the market witnessed a noticeable increase in both trade volumes and turnover, where volume increased from 0.355 million in 2001 to 227 million in 2010, and value of traded shares from Ushs.509 million in 2001 to Ushs.42billion in 2010(USE Annual Report, 2010; Mugabi, 2011). The modest turnover in 2010 was due to the global economic downturn. Turnover was up 100 percent in 2010 compared to 2009. Market capitalization rose 79 percent from Ushs.7.1 trillion

[1]As of June 2011, the Uganda Securities Exchange (USE) traded fourteen (14) listed local and East African companies and had started the trading of fixed income instruments. Two new listings were expected by the end of Q1:2012.

in 2009 to Ushs.12.8 trillion in 2010. The USE All Share Index (ALSI) rose 62 percent from Ushs.733 in 2009 closing at Ushs.1188 in 2010 (USE Annual Report, 2010).This data shows an up and downward movement in the index and a continuous increase in the market capitalization since 2003, which is a positive signal of healthy performance of listed companies.

The stock exchange is a secondary market that provides a platform for the investors to buy and sell the stocks more easily. The decision whether to buy or sell a particular stock is one of the most important decisions an investor has to make after scrutinizing the stock market price and other attributes. Nonetheless, a number of modelling techniques have been developed and used by researchers and investors to determine the value of a stock. Some of these modelling techniques include the Capital Asset Pricing Model (CAPM) developed by Sharpe (1964), Lintner (1965) and Mossin (1966) that explain the relationship between the expected return and systematic risk. The Arbitrage Pricing Theory (APT) developed by Ross (1976) and proposed as an alternative to the CAPM since it assumes several macroeconomic factors or theoretical market indices that affect the stock return, etc. This study aims at examining the influence of macroeconomic determinants on stock market price using the APT framework.

Problem Statement

According to the standard stock valuation model, the determinants of stock market price are the expected cash flows from the stock and the required rate of return proportionate with the cash flow's risk. It has been proven that economic variables via their effects on future dividends and discount rates contribute to the level of stock return (Chen, Roll, & Ross, 1986). Theyconcluded that stock market returns are priced in accordance with their exposures to systematic economic news, measured as innovations in state variables (Chen, Roll, & Ross, 1986). However this kind of finding needs to be tested on the capital market of Uganda as there are variations in terms of findings among various studies in different countries and different markets (Anokye & Tweneboah, 2008; Humpe & Macmillan, 2009; Imran, Kashif, Ayse, Muhammad, & Hassan, 2010; Mohamed, Sohail & Hussain, 2009). Besides, empirical examinations ofthe USEarescanty; a reason why a Ugandan based study becomes a matter of curiosity. Hence, understanding the macroeconomic determinants of stock market price is very important to current and future investors on the USE. Since Uganda is attracting global attention as a market with investment potential, an empirical investigation of the determinants of stock market price is fundamental for the stock market's expansion.

Literature Review

The literature on the effects of macroeconomic variables on stock market price dates back to the late 1970s (Menike, 2006). However over the years, the observed pattern of influence of macroeconomic variables on stock market price varies from one study to another in different capital markets. Therefore, in the following paragraphs, the variables and methodology used in various countries by various researchers for a similar purpose have been reviewed. There have been many attempts in the past to find out relationship between stock prices and macroeconomic variables. All these studies have found significant short-run and long-run relationship between stock prices or stock returns and macroeconomic variables.

Maysami & Koh (2000) examined the long-term equilibrium relationships between the Singapore stockindex and selected macroeconomic variables which included money supply (M2), consumer price index, industrial production index, 3-month interbank offer rate, yield on 5-year government securities and total domestic export, as well as among stock indices of Singapore, Japan and the United States. They found changes in two measures of real economic activities, industrial production andtrade, are not integrated of the same order as changes in Singapore's stock market levels. However they detected that changes in Singapore's stock market levels does form a cointegrating relationship withchanges in price levels, money supply, short and long-term interest rates, and exchange rates. With changes in interest and exchange rates contributing significantly to the cointegratingrelationship while price levels and money supply did not. This suggested that the Singaporestock market is interest and exchanges rate sensitive. They also found the Singapore stock market to be significantly and positively cointegrated with stock markets ofJapan and the United States.

Gunasekarage, Pisedtasalasi& Power (2004) examined both long-run and short-run relationships between the Colombo stock market index and the macroeconomic variables which included the money supply (M1), the 3-month treasury bill rate (as a measure of interest rates), the consumer priceindex (as a measure of inflation) and the exchange rate using a battery of tests, whichincluded the impulse response functions and variance decompositions.

Their analysis provided some support for the argument that the lagged values of macroeconomic variables such as the consumer price index, the money supply and theTreasury bill rate have a significant influence on the stock market.In addition, they also found the exchange rate did not have any influence on the stock prices.

Brahmasrene & Jiranyakul (2007) examined the relationship between stock market index and selectedmacroeconomic variables which included industrial production index, money supply (M2), inflation, nominal exchange rate, long-term interest rate and oil price during the pre-financial crisis and post financial crisis in Thailand. For the pre-financial crisis, they found the stockmarket index, the industrial production index, money supply, exchange rate, and world oil prices containing a unit root and are integrated of orders one. They also found at least one cointegrating or long-run relation between the stockmarket index and a set of macroeconomic variables. With money supply having a positive impact on thestock market index while the industrial production index, the exchange rate and oil prices having anegative impact. For the post-financial crisis, they also found all variables are integrated at different orders and cointegration existed between the stock market index and macroeconomic variables. In addition,they found money supply to granger-cause stock market returns.

Humpe & Macmillan (2009) studied the influence of a number of macroeconomic variables which included real industrial production, consumer price index, money supply (M1), real 10-year US treasury bond yield and the real official discount rate on stock prices in the US and Japan. They found the data for the US are consistent with a single cointegration, where stock prices are positively related to industrial production and negatively related to both the consumer price index and the long-term interest rate. They also found an insignificant though positive relationship between the US stock prices and the money supply. However, for the case of Japan, they found two cointegrating vectors. For the first cointegrating vector, they found stock prices to be positively influenced by industrial production and negatively influenced by money supply. For the second cointegrating vector, they found industrial production to be negatively influenced by the consumer price index and the long-term interest rate

Maysami, Howe & Hamzah (2004) found a positive relationship between inflation rate and stock returns. This is contrary to the study (Sohail & Hussain, 2009) that suggested a negative relationship. They found apositive and negative relationship between interest rate and stock returns in the short-run and long-run respectively. In the same vein, they also found apositive relationship between money supply and stock return. Their finding is consistent with the findings of Olukayode & Akinwande (2009) who examined the long-run and short-run effect of macroeconomic variables on the Nigerian capital market.

Hinaunye (2011) investigated the determinants of stock market prices in Namibia by using the Vector Autoregression (VAR) framework which covered quarterly data from period 1998 Q1 to 2009 Q4. He found a positive relationship between economic activity, money supply and stock market prices whereas inflation and interest rates showed a negative relation. Meanwhile, another study based on Pakistan's stock market by Sohail & Hussain (2009) showed there is cointegration between inflation, money supply, exchange rate and interest rate with stock prices. In other studies by Maghayereh (2003) and Al-Sharkas (2004)investigated the long-run relationship between the Jordanian stock prices and selected macroeconomic variables which included domestic export, foreign reserves, money supply (M1, M2), treasury bill rates, inflation, industrial production, again by using Johansen's methodology with monthly time series data. Their findings indicated that macroeconomic variables reflect in stock prices in the Jordanian capital market.

Anokye & Tweneboah (2008) found interesting results on the relationship between the Ghana's Stock Exchange index and four macroeconomic variables. They use quarterly data for on stock prices, inwardforeign direct investments,the treasury bill rate (as a measure of interest rates), theconsumer price index (as a measure of inflation), and the exchange rate to analyze both long-run and short-run dynamic relationshipsbetween the stock market index and the macroeconomic variables using Johansen's multivariate cointegration testand innovation accounting techniques. They found that there is cointegration betweenmacroeconomic variables identified and Stock prices in Ghana indicating long-runrelationship. In addition, their results of Impulse Response Function (IRF) and Forecast Error VarianceDecomposition (FEVD) indicated that interest rate and Foreign Direct Investment (FDI)are the key determinants of the share price movements in Ghana.

In another study in Malaysia by Mohamed, Wisam, Hassama, & Amin (2009),theystudiedthe effect of macroeconomic variables which included consumer

price index as a measure of inflation rate, money supply (M2), and nominal effective exchange rate on stock prices for Malaysia. Their findings revealed that thevariables share a long-run relationship in both periods, indicating that deviations in the short-run stock prices are adjusted towards the long-run value. Furthermore, the long-run equilibrium indicated that there is a positive relationship between inflation and stock prices, thus a good hedge against inflation. As for money supply (M2), they found a negative relationship between money supply and stock prices. As for exchange rate, they found a positive interaction in the period before and negative interaction in the period after crisis, hence creating downward pressure on stock prices in the long-run.

Rahman, Sidek, & Tafri (2009)replicated the above study to examine the interactions between selected macroeconomic variables which included money supply (M2), 3-month treasury bill as a measure ofinterest rate , real exchange rate , reserves , industrial production index and the Kuala Lumpur Composite Index (KLCI) as a proxy for Malaysian stock market employing a Vector Autoregression (VAR) framework which covered a period from January 1986, which marked the commencement offinancial and capital account liberalization to March 2008. Their results revealed that the reserves and industrial production index are positively and significantly related to the KLCI while exchange rate and money supplyarenegatively and significantly tothe KLCI. In addition, the study revealed that the interest rate has a negative influence on the KLCI but not significant.

Data and Methodology

1.1 Data

The study used monthly time series data from January 2003 to March 2011. The dependent variable, *stock market price (SMP)*was obtained from Uganda Securities Exchange (USE) andmonth end closing value of the USE All Share Index (ALSI) were used as a proxy for stock market price.The independent variables namely: Consumer Price Index (CPI) as a proxy for*inflation (INF)*was obtained from Uganda Bureau of Statistics (UBOS),3-months Treasury Bills a proxy for*interest rate (INT)*,M3 combined as M2 + Foreign Exchange Accounts as a proxy for *money supply (MSY)*and Real Effective Exchange Rate (REER) as a proxy for *exchange rate (EXR)*were obtained from Bank of Uganda(BOU).

1.2 Methodology

As a precursor to thedata analysis, it was important that the serieswere tested for stationarity. The most common methods and techniques of testing for stationarity are Augmented Dickey Fuller (ADF) test (Dickey & Fuller, 1981, 1984) and Phillips-Perron (PP) test (Phillips & Perron, 1988).Therefore, to ensure that the series entering the model to be estimated are non-explosive and also to address the issue of tests with low powers, ADF and PP were used.

1.2.1 Augmented Dickey Fuller (ADF)Test

The ADF test was used because the extra lagged terms of the dependent variable can be included on the basis of Akaike Information Criteria (AIC) or Schwartz Bayesian Criteria (SBC) decision to eliminate autocorrelation. In order to test for unit root through the ADF, the following equation was used;

$$\Delta Y_t = \beta_1 + \gamma Y_{t-1} + \sum_{i=1}^{n} \delta \Delta Y_{t-i} + \varepsilon_t \qquad (1)$$

Where, $Y_t = \ln SMP_t, \ln INF_t, \ln MSY_t, \ln INT_t, \ln EXR_t$; $\beta_1, \gamma$and δ are coefficients; Y_{t-1} is the stochastic trend;n is the appropriate lag length;

1.2.2 Phillips-Perron (PP) Test

The PP test differs from the ADF test mainly in how it deals with higher-order serial correlation and heteroscedasticity in the error terms. The PP test is free from parametric errors and it allows the disturbances to be weakly dependent and heterogeneously distributed (Sohail & Hussain, 2011). Therefore, PP was also applied to check the stationarity. The test regression for the PP test was given as:

$$\Delta Y_t = \alpha_1 + \gamma Y_{t-1} + \alpha_2(t - T/2) + \sum_{i=1}^{m} \emptyset_i \Delta Y_{t-1} + \mu_{2t} \qquad (2)$$

Where,$Y_t = \ln SMP_t, \ln INF_t, \ln MSY_t, \ln INT_t, \ln EXR_t$; α_1, γ and δ are coefficients;ΔY_t is the first difference operator; T is the sample size; μ_{2t} is the covariance stationary random error term; lag length m was decided according to Newly & West (1987), suggestions using Bartlett Kernel.

1.2.3 Cointegration Test

To determine the long-run relationship between the stock market price and the macroeconomic variables, a procedure developed by Johansen (1988) and applied in Johansen & Juselius (1990) methodology was used. This technique uses a maximum likelihood method to determine the number of cointegrating vectors in non-stationary time series with imposed restrictions. The Johansen's method takes its starting point in the Vector Autoregression (VAR) of order p as

$$Y_t = \mu + \Pi_1 Y_{t-1} + \Pi_2 Y_{t-2} + \cdots + \Pi_p Y_{t-p} + \varepsilon_t \qquad (3)$$

Where, $Y_t = \ln SMP_t, \ln INF_t, \ln MSY_t, \ln INT_t, \ln EXR_t$; Y_t is a5×1vector of variables that are integrated of order one, denoted as$I(1)$; Π_i is a (5×5)matrix of parameters; and $\varepsilon_t$is a 5×1 vector of unobservable error terms assumed to be identically and independently distributed. The VAR was re-written as:

$$\begin{bmatrix} \Delta lnSMP_t \\ \Delta lnINF_t \\ \Delta lnMSY_t \\ \Delta lnINT_t \\ \Delta lnEXR_t \end{bmatrix} = \begin{bmatrix} \mu_{SMP} \\ \mu_{INF} \\ \mu_{MSY} \\ \mu_{INT} \\ \mu_{EXR} \end{bmatrix} + \Pi \begin{bmatrix} lnSMP_{t-1} \\ lnINF_{t-1} \\ lnMSY_{t-1} \\ lnINT_{t-1} \\ lnEXR_{t-1} \end{bmatrix} + \Gamma_k \begin{bmatrix} \Delta lnSMP_{t-1} \\ \Delta lnINF_{t-1} \\ \Delta lnMSY_{t-1} \\ \Delta lnINT_{t-1} \\ \Delta lnEXR_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{SMP} \\ \varepsilon_{INF} \\ \varepsilon_{MSY} \\ \varepsilon_{INT} \\ \varepsilon_{EXR} \end{bmatrix} \qquad (4)$$

Where,Γ_k is a 5 x 5 polynomial coefficient matrix to be estimated, k is the lag operator and Γ represents short-run adjustments among variables across the five equations in the system. The symbol Δdenotes the first difference operator, Πis the error correction component in levels and ε's normally distributed with zero mean and constant variance. In this case, testing for cointegration entails testing how many linearly independent columns are there inΠ, effectively testing for the rank of MatrixΠ (Mitchell-Innes, 2006). Johansen proposes both the maximum eigenvalue and trace tests to identity the rank ofΠ. Johansen & Juselius (1990) proved that the maximum eigenvalue test produces more robust results and it was more powerful than the trace test. In light of that, the study presented results of the maximum eigenvalue and trace tests.

The Johansen method requires that the appropriate lag length for the VAR to be estimated. Brooks (2008) suggests the use of multivariate versions of information criteria, which include the sequential modified likelihood ratio (LR), Akaike information criterion (AIC), Hannan-Quinn information criterion (HQ), the Final prediction error (FPE) and Schwarz information criterion (SIC). But these information criterions frequently produce contradictory VAR order selections and therefore it was vital to use information criterion approach and the a priori knowledge from economic theory to select a proper order of the VAR.

1.2.4 Model Specification

To explore the long-run relationship between the macroeconomic variables and the stock market price, the following econometric model was specified as follows:

$$lnSMP = \beta_0 + \beta_1 lnINF + \beta_2 lnMSY + \beta_3 lnINT + \beta_4 lnEXR + \varepsilon_t \qquad (5)$$

Where,$lnSMP$ = natural logarithm of stock market price; $lnMSY$ = natural logarithm of money supply; $lnEXR$ = natural logarithm of exchange rate; $lnINT$ = natural logarithm of interest rates; $lnINF$= natural logarithm of Inflation and ε_t = disturbance term.

Following model was estimated to explore the short-run dynamics between the variables and their long-run equilibrium relation:

$$\Delta lnSMP_t = \alpha + \sum_{i=1}^{p} \beta_i \, \Delta lnSMP_{t-1} + \sum_{i=1}^{p} \phi_i \, \Delta lnINF_{t-1} + \sum_{i=1}^{p} \delta_i \, \Delta lnMSY_{t-1} + \sum_{i=1}^{p} \lambda_i \, \Delta lnINT_{t-1} + \sum_{i=1}^{p} \gamma_i \, \Delta lnEXR_{t-1} + \mu ECT_{t-1} + \theta_t \qquad (6)$$

Where, Δ is difference operator, p is the chosen lag length, $\beta, \phi, \delta, \lambda, \gamma$ are parameters, $\mu$is the error correction term (ECT) or speed of adjustment term (calculated from the long-run results) and θ is the error term.

1.2.4.1 Diagnostic and Stability Tests

The properties of equation (6) are sensitive to these underlying assumptions: normality, conditional heteroscedasticity and autocorrelation.But, these assumptions are usually violated in the real world (Baharuddin, Khamis, Mahmood, & Dollah, 2011). Thus, in order to determine the validity of equation (6), the following tests were conducted; Autoregressive Conditional Heteroscedasticity (ARCH) test, Jarque-Bera Normality test and Breusch-Godfrey serial correlation Lagrange Multiplier (LM) test.

Finally, stability tests of equation (6)employing cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests were conducted. The CUSUM and CUSUMSQ statistics are updated recursively and plotted against the break points. If the plots of CUSUM and CUSUMSQ statistics stay within the critical bonds of 5% level of significance, the null hypothesis of all coefficients in the given regression being stable cannot be rejected.

Empirical Results

1.3 Unit RootTest Results

As mentioned in the previous section, ADF and PP unit root tests were employed. The results of the ADF and PP unit root tests are shown in **Table 1**. The results shown are for the test at level and first difference. The unit root tests werecarried out when there is an intercept and no trend. In ADF and PP unit root tests, the null hypothesis of a unit root was rejected against the alternative if the test statistic was more negative than the critical value at 1%, 5% and 10% levels of significance. This implied that the series does not contain a unit root, thus, it is stationary.

Table 1: ADF and PP Unit Root Test Results

	At Level		At First Difference	
Variables	**ADF**	**PP**	**ADF**	**PP**
lnSMP	-1.793974 (0)	-1.764532 (3)	-10.94487 (0)	-10.93686 (2)
lnINF	-2.131924 (1)	-1.951371 (2)	-7.327109 (0)	-7.268506 (2)
lnMSY	-2.265306 (1)	-2.092952 (1)	-15.85963 (0)	-17.00094 (8)
lnEXR	-2.524625 (1)	-2.351788 (3)	-8.098016 (0)	-8.101447 (1)
lnINT	-3.215024 (1)	-2.248428 (1)	-6.024969 (0)	-5.53893 (8)
Critical Values				
1%	-3.49844	-3.49844	-3.49844	-3.49917
5%	-2.89123	-2.89123	-2.89123	-2.89155
10%	-2.58268	-2.58268	-2.58268	-2.58285

Notes:

1) *, ** and *** represent a stationarity at 1%, 5% and 10% level respectively.

2) The critical values are obtained from MacKinnon (1996) one-sided p-value.

3) Figure in () is the optimal lag length selected by Information Criterions

The ADF unit root tests for the variable at first difference were statistically significant at 1%, 5% and 10% levels of significance meaning the hypothesis claiming that the variables have a unit root can be rejected. To address the issue of tests with low power, the PP test wasimplemented to justify the results of the ADF test. **Table 1**depicts the results of the PP unit root test andthe results show that the variables were non-stationary at level but after first differencing, they all became stationary.It looks like the results of the informal graphical presentation of stationarity agree with ADF and PP formal stationarity tests. It was concluded that all the series have an order of integration of one (1) hence okay to proceed with cointegration tests.

1.4 Cointegration Test Results

The existence of a long-run relationship between the stock market price and the macroeconomic variables was examined.But, before testing for cointegration, an appropriate lag length for the VARwasf determined usingthe information criterionwith a maximum of 8 lags.**Table** in the appendix shows that FPE, AIC and HQ selected 2 lags while SIC chose 1 lag and the LR selected 4 lags for the VAR. 1 lag for the VAR was selected and**Figure** in the appendix shows that no root lies outside the unit circle, thus VAR satisfies the stability condition. The cointegration test was conducted using the assumption of no trend but a constant in the series. **Table** presents the cointegration test results applying the trace and maximum eigenvalue test statistics. The first part of **Table** presents the cointegration test based on the trace test, while the second part presents the results based on maximum eigenvalue test. The trace statistic tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating relations. The null hypothesis of no cointegrating vectors was rejected since the test statistic of about 78.52 was greater than the 5% critical value of approximately 69.82 hence, the trace statistics specifies 1 cointegrating relationship at 5% level of significance.

Table 3: Cointegration Test Results

Unrestricted Cointegration Rank Test Based on Trace				
Null Hypothesis	Alternative Hypothesis	Test Statistic	Critical Value	Prob.**
r=0	r>0	**78.5236***	69.81889	0.00860
r≤1	r>1	34.83180	47.85613	0.45690
r≤2	r>2	18.72498	29.79707	0.51280
r≤3	r>3	9.27551	15.49471	0.34050
r≤4	r>4	1.65364	3.84147	0.19850
Notes: 1) Trace test indicates 1 cointegrating eqn(s) at 5% level of significance 2) * denotes rejection of the hypothesis at the 0.05 level 3) **MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test based on Maximum Eigenvalue				
Null Hypothesis	Alternative Hypothesis	Test Statistic	Critical Value	Prob.**
r=0	r=1	**43.69181***	33.87687	0.00250
r=1	r=2	16.10681	27.58434	0.65670
r=2	r=3	9.449473	21.13162	0.79460
r=3	r=4	7.621872	14.2646	0.41840
r=4	r=5	1.653636	3.841466	0.19850
Notes: 1) Max-eigenvalue test indicates 1 cointegrating eqn(s) at 5% level of significance 2) * denotes rejection of the hypothesis at the 0.05 level 3) **MacKinnon-Haug-Michelis (1999) p-values				

The maximum eigenvalue tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of $r + 1$ cointegrating relations. The maximum eigenvalue test also rejected the null hypothesis of no cointegration since the test statistic of about 43.69 was greater than the 5% critical value of approximately 33.88. Therefore the maximum eigenvalue test put forward only 1 cointegrating relationship in the study. In conclusion, the VECwas limited to one cointegrating vector as indicated by the trace and maximum eigenvalue tests.

1.5 Model Estimation Results

Given that there was at least one cointegrating vector among the variables in the system, the analysis normalized the cointegrating vector on *lnSMP* and we went ahead to estimate the long-run and short-run relationship.

1.5.1 Long-Run Estimation Results

The long-run relationship between *lnSMP* and the macroeconomic variables are presented in **Table** and all the variables are statistically significantly.

Table 4: Normalized Cointegrating Coefficients

DlnSMP	C	DlnINF	DlnMSY	DlnEXR	DlnINT
1.0000	53.59716	-11.2636	10.85049	-11.90164	0.568244
		(3.30637)	(1.47123)	(1.93498)	(0.18495)
		[-3.40663]	[7.37513]	[-6.15077]	[3.07245]

Notes:

1) Standard errors in ( ) & t-statistics in [ ]

The coefficient signs of the normalized cointegrating vector in **Table** are reversed as they appear on the left hand side of the equation(Johansen & Juselius, 1990). Therefore, the first normalized equation was estimated as:

$$\mathbf{DlnSMP} = -53.60 + 11.26\ \mathbf{DlnINF} - 10.85\ \mathbf{DlnMSY} + 11.90\ \mathbf{DlnEXR} - 0.57\ \mathbf{DlnINT}$$

The first normalized equation depicted that in the long-run, there are two variables which possess a positive relationship namely inflation (*lnINF*) and exchange rate (*lnEXR*) and the other variable two variables possess a negative relationship with the stock market price which are moneys supply (*lnMSY*) and interest rate (*lnINT*). This can be interpreted as an increase in inflation causes stock market price to increase by 11.26 percent. Likewise, an increase exchange rate causes stock market price to increase by 11.9 percent while an increase in money supply and interest rate causes stock market price to decrease by 10.85 and 0.57 percent respectively.

The long-run relationship between inflation (INF) and stock market price (SMP)shows a positive impact in the stock market price which implies that equities are hedged against inflation and this is consistent with the studies of Mansor & Sulaiman (2001), Maysami, Howe & Hamzah (2004), Humpe & Macmillan (2009), Anokye & Tweneboah (2008), Karagoz, Ergun & Karagoz (2009),Mohamed, Wisam, Hassama & Amin (2009), Olukyode & Akinwande (2009), Hosseini, Ahmad & Lai (2011), Sohail & Hussain (2011) and Hussin, Muhammad, Abu & Awang (2012).

Money supply (MSY)is found to be negativelyrelatedtostock market price (SMP)and the same results are also consistent with the studies of Mansor & Sulaiman (2001), Ching-Hong & Jayaraman (2007), Karagoz, Ergun & Karagoz (2009), Keray (2009), Mohamed, Wisam, Hassama & Amin (2009), Rahman, Sidek & Tafri (2009), Waliullah (2010), Sohail & Hussain (2011)and Hussin, Muhammad, Abu & Awang (2012)but it is in contrast with the results of Al-Sharkas (2004), Gunasekarage, Pisedtasalasi &Power (2004), Maysami, Howe & Hamzah (2004), Brahmasrene & Jiranyakul (2007), Olukyode & Akinwande (2009), Sohail & Hussain (2009) and Hinaunya (2011).

A significant negative long-run relationship between interest rate (INT) and stock market price (SMP) is shown. This finding is consistent with the previous studies (Maghayereh, 2003; Gunasekarage, Pisedtasalasi & Power, 2004; Ching-Hong & Jayaraman, 2007; Anokye & Tweneboah, 2008; Karagoz, Ergun & Karagoz, 2009, Keray, 2009; Rahman, Sidek & Tafri, 2009; Hinaunya, 2011; Sohail & Hussain, 2011; Hussin, Muhammad, Abu & Awang, 2012) but it is in contrast with the results of Al-Sharkas (2004), Ratanapakorn & Sharma (2007), Humpe & Macmillan (2009), Olukyode & Akinwande (2009), Sohail & Hussain (2009) and Waliullah (2010).

Stock market price (SMP)is found to be positively affected by the exchange rate (EXR). Theoretically, the effects of currency depreciation on stock markets can be either negative or positive. The same results are reported by Karagoz, Ergun & Karagoz (2009), Keray (2009), Sohail & Hussain (2009) and Sohail & Hussain (2011) but Maysami, Howe & Hamzah (2004), Brahmasrene & Jiranyakul (2007), Anokye & Tweneboah, (2008), Mohamed, Wisam, Hassama & Amin (2009), Olukyode & Akinwande (2009), Rahman, Sidek & Tafri (2009), Waliullah (2010), and Hussin, Muhammad, Abu & Awang (2012)reported a negative association between exchange rate and stock market price.

1.5.2 Short-Run Estimation Results

To investigate the short-run relationship among the variables, a vector error correction mechanism was applied. The results of VEC are shown in **Table** in the appendix with the coefficient of*CointEq1* whichshowsthe speed adjustment and disequilibrium of the previous month. From **Table** in the appendix, the adjustment in the stock market pricewas insignificant at all levels of significance.Thus, the stock market price do not adjust to the previous equilibrium error and past macroeconomic variables have no significant explanatory power over the current stock market price.

Itwas observed from **Table** in the appendix, that three series namely *lnSMP*, *lnMSY* and *lnINT* showed evidence of error correction on *CointEq1* as shown by the negative coefficient while *lnINF* and *lnEXR* did not. However, only *lnMSY* had the most significant coefficient with a t-value of approximately 3.00. The other series with the correct signs had very low t-values which were less significant. Consequently, an error correction model for *lnSMP*, which includes the residuals from the static cointegration regression between *lnSMP* and *lnINF*, *lnMSY*, *lnEXR, lnINT* and error correction term (ECT) as explanatory variables was specified in the model specification. To ensure that outstanding periods were captured, a dummy variable was included in estimating the model. The results of the estimates of the general error correction model for stock market price are presented in **Table** in the appendix. Although the model looks fairly well estimated, it was not interpreted in its present form. The basic essence of the general specification was to capture the main dynamic processes in the model. It sets the lag length such that the dynamic processes would not be constrained by too short a lag length. As evident in the general specification, the lag length was set at two bearing in mind the possible problems of low degrees of freedom if higher order lags were used.

As is traditional, the general model was reduced to achieve a specific model, which is both data admissible theory consistent and interpretable. Parsimony maximizes the goodness of fit of the model with a minimum number of explanatory variables. The reduction process was mostly guided by statistical considerations, intuition and luck rather than economic theory(Adam, 1992). Thus, the Specific reduction process made use of a stepwise regression procedure, subjecting each stage of reduction process to several diagnostic tests before finally arriving at an interpretable model.Results of the specific error correction model for stock market price arepresented in **Table** and the interpretation of the dynamic process in this model was easy.

Table 7: Results of Specific error correction model, 2003-2011, Dependent Variable: DlnSMP

Variable	Coefficients	Std. Errors	*t* -Statistics	*p* -values
DlnMSY	-0.30976	0.25035	-1.23731	0.21920
DlnINT(-1)	0.07453	0.06670	1.11738	0.26680
DlnINF	-1.89171	0.87544	**-2.160872****	0.03340
DlnINF(-1)	1.51857	0.94304	1.61029	0.11090
DlnEXR(-1)	1.04628	0.34629	**3.021408***	0.00330
DUMMY	-0.04592	0.02142	**-2.144018****	0.03480
ECT(-1)	-0.20731	0.05878	**-3.527148***	0.00070
C	0.00772	0.00867	0.89056	0.37560
AIC = -2.237332	SIC = -2.024985	F-statistic = 3.215198		
Diagnostic Tests:				
R^2	20.18%			
$\check{R}^2$	13.91%			
DW-d	2.0485			
JB	1.74280 [0.41837]			
AR[1]	0.07864 [0.78640]			
ARCH[1]	0.15743 [0.69240]			

Notes:

1) *, **, *** indicates significance at 1%, 5% and 10% respectively;

2) AIC is the Akaike Information Criterion;

3) SIC is the Schwarz Information Criterion;

4) JB is the Jarque-Bera statistic for testing normality;

5) AR is the lagrange multiplier test of second order serial correlation;

6) ARCH is the Autoregressive Conditional Heteroscedasticity test.

It can be observed from **Table** , the coefficient of the error correction term (ECT_{t-1}) carries the expected negative sign and it is highly significant at the 5% level of significance. The significance of the error correction term supports cointegration and suggests the existence of long-run steady-state equilibrium between stock market price and inflation, money supply, exchange rate and interest rate.

In fact the ECT indicates a feedback of about 21 percent of the previous month disequilibrium from long-run elasticity of stock market price and inflation, money supply, exchange rate and interest rate. In other words, the coefficient of the error correction term measures the speed at which stock market price adjusts within 5 months (1/0.2073=4.824) to eliminate the disequilibrium. This means that the stock market price seem to adjust quickly towards the long-run equilibrium. To put another way, any shock that forces stock market price to deviate from long-run value will not take long to correct unless there is another shock that could counter the initial ones.

The short-run coefficient of money supply carries a negative but not significant at any level of significance. In the same manner, the long-run coefficient also carries a negative sign but significant at 5% significance level. However, this result needs to be accepted with caution as there's need to test other definitions of money supply such as M2 and M1 which could produce different results.

The coefficient of the interest lagged one period carries a positive sign in the short-run but not statistically significant at any level of significance. This means that short term movement in the interest rate does not affect the stock market price.Inflation carries a negative sign and its coefficient is statistically significant at 5 percent level of significance in the short-run. This is true because the real value of stocks decreases as the nominal price level is going up. The real value of returns in the upward movement of stock market price is eroded by rapid changes in inflation.

The short-run coefficient of the exchange rate lagged one period carries a positive sign but is significant at 1% level of significance. This means that the appreciation of the local currency is an incentive to investment in the stock market.The dummy variable has been included in the Specific error correction model to improve the chances of error normality. This indicator variable takes the values 0 or 1 to indicate the presence or absence of some categorical effect that may shift the outcome of a problem. In this analysis, 1 is placed for the 2 months in 2003, 4 months in 2004, 2 months in 2005, 1 month in 2006, 2 months in 2007, 4 months in 2008, 2 months in 2009 and 1 month in 2010. The coefficient of the dummy variable carries a relative high t-value and is significant at 5% level of significance.

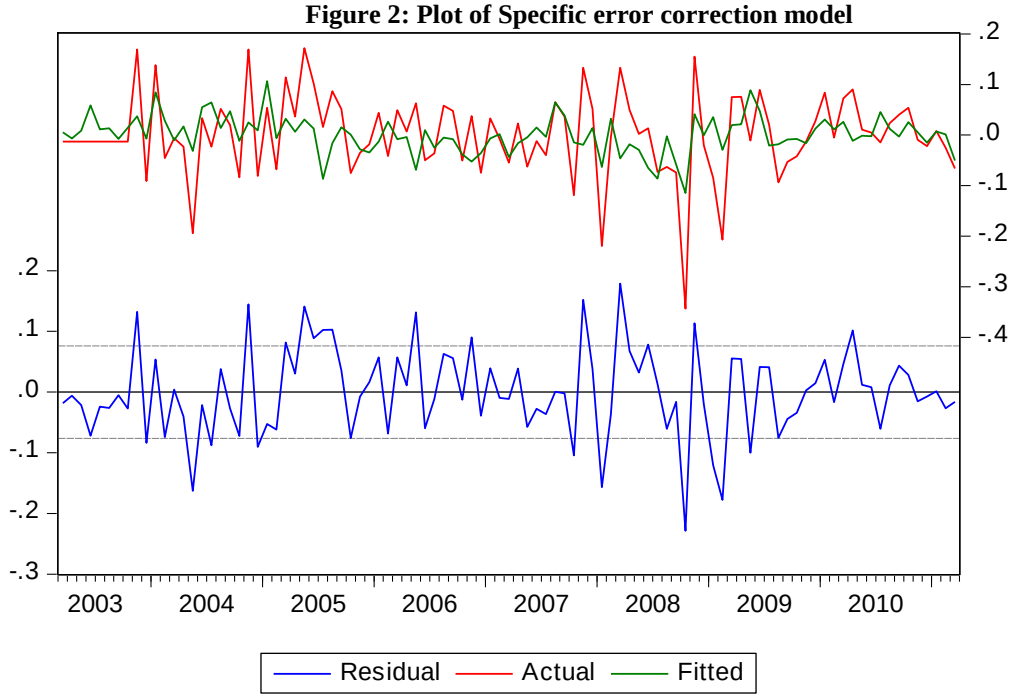
1.5.2.1 Diagnostic Test for the Specific Error Correction Model

It can be observed that the specific model has a better fit compared with the general model as indicated by a higher value of the F-statistic (3.2152), which is significant at the 5% level of significance compared with the F-statistic (1.7476) of the general model which is not significant at 5% significance level. The structural variables of the reduced model explain the stock market price better than the general model as indicated by the values of their adjusted coefficients of multiple determinations. Specifically, the adjusted R^2 of the reduced model (0.1391) is higher than the adjusted R^2 of the general model (0.1118). Similar evidence is given by the value of the standard error of the regression (σ), Durbin-Watson (DW) static for first-order serial correlation and the two model information criteria, that is the Schwarz information criteria (SIC) and the Akaike Information Criteria (AIC). A model with lower standard error of the regression is preferred in terms of a rival model. This also applies to the values of the Schwarz Information Criteria (SIC) and the Akaike Information Criteria (AIC).

A series of other diagnostic tests are applied to the model in order to test the validity of its estimates and their suitability for policy discussions. On the whole, three residual tests aside the DW test for first-order serial correlation are carried out to test the normality and independence of the residuals of the preferred model. The Jarque-Bera Normality test on the residuals, with F-statistic of 1.74280, could not reject the null hypothesis of normality in the residuals, as indicated by the level of significance shown in **Table** . Furthermore, the Breusch-Godfrey serial correlation Lagrange Multiplier (LM) test for higher order serial correlation with a calculated F-statistic of 0.07386 could also not reject the null hypothesis of absence of serial correlation in the residuals. Finally, the Autoregressive Conditional Heteroscedasticity (ARCH) test is used to test for heteroscedasticity in the error process in the model. The results of the calculated F-statistic of 0.1574 indicated absence of heteroscedasticity in the model. From the battery of diagnostics tests presented and discussed above, the study concludes that the model is

well estimated and that the observed data fits the model specification adequately, thus expect that the residuals are distributed as white noise and the coefficients valid for policy discussions.The residual graph, which shows the actual and fitted observations, is depicted in **Figure** . It indicates that the fitted observations are as close as possible to their observed value, which is the hallmark of Least Squares estimation.

Figure 2: Plot of Specific error correction model



1.5.2.2 Test for the Specific Error Correction Model Stability

Lastly, the Specific error correction model is tested for stability using the CUSUM of squares stability tests as shown in **Figure 1** and **Figure 2** in the appendix. The results show thatthe estimated model is stable and fallsinside the 5 percent critical lines. Thus, the study concludes that the estimated stock market price function is structurally stable. The significance of the structural stability of this function is that the parameters of the stock market price are constant and do not change over time. This makes it possible for the model to be used on post sample data or in policy simulations.

Conclusions and Policy Recommendations

1.6 Conclusions

The stock market of Uganda seems to be driven more by changes in domestic factors, particularly inflation (INF), exchange rate (EXR), interest rate (INT) and money supply (MSY). Specifically, we note that inflation, exchange rate exert a positive effect on stock market price in the long-run. However, money supply (MSY), interest rate (INT) and stock market price (SMP) are negatively associated in the long-run. We also observe a positive effect of exchange rate and negative effect of inflation on stock market price in the short-run. Other notable results are: stock market price contains valuable information for future variations in macroeconomic variables especially the price level.

1.7 Policy Recommendations

First, since the stock market functions in a macroeconomic environment, it is essential that the atmosphere is favorable to allow the market forces of demand and supply to have effect. Second, the monetary authorities should be very cautious in implementing exchange rate and monetary policies as they may have adverse effects on Uganda's financial market.

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APPENDIX

Table 2: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	525.9142	NA	7.34E-12	-11.44866	-11.3107	-11.3930
1	887.9369	676.3062	4.46E-15	-18.85576	**-18.02800***	-18.5218
2	934.4862	81.84482	**2.79e-15***	**-19.32937***	-17.81181	**-18.71713***
3	947.2169	20.98477	3.70E-15	-19.05971	-16.85236	-18.1692
4	973.1061	**39.82944***	3.72E-15	-19.07925	-16.18211	-17.9104
5	996.5732	33.52454	4.00E-15	-19.04557	-15.45862	-17.5985
6	1004.647	10.64722	6.16E-15	-18.67357	-14.39683	-16.9482
7	1030.154	30.83231	6.64E-15	-18.68471	-13.71817	-16.6810
8	1061.325	34.25321	6.54E-15	-18.82032	-13.16399	-16.5383

Notes:

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SIC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Figure 1: Inverse Roots of AR Characteristic Polynomial

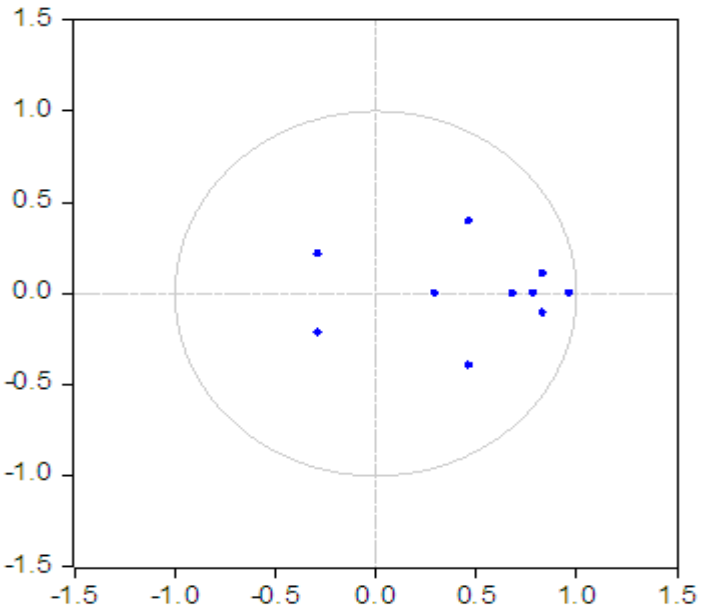

Table 5: Results of Vector Error Correction Estimates

Variables	D(lnSMP)	D(lnINF)	D(lnMSY)	D(lnEXR)	D(lnINT)
CointEq1	-0.02215	0.00361	**-0.021454****	**0.017702****	-0.03661
	[-1.16730]	[1.55501]	[-3.00719]	[3.28082]	[-1.46201]
D(lnSMP(-1))	-0.15178	0.00356	**-0.083472****	0.01862	0.23677
	[-1.46671]	[0.28164]	[-2.14505]	[0.63266]	[1.73365]
D(lnINF(-1))	0.33121	**0.317397****	-0.18695	0.07557	1.74410
	[0.33676]	[2.63987]	[-0.50549]	[0.27015]	[1.34366]
D(lnMSY(-1))	0.27186	-0.01172	**-0.284938****	-0.10023	-0.15062
	[1.06018]	[-0.37373]	[-2.95494]	[-1.37433]	[-0.44506]
D(lnEXR(-1))	**0.713482*****	0.06174	0.13411	**0.211131*****	0.40735
	[1.90932]	[1.35152]	[0.95437]	[1.98665]	[0.82598]
D(lnINT(-1))	0.02764	-0.00951	**0.062459****	-0.01925	**0.465435***
	[0.39255]	[-1.10447]	[2.35924]	[-0.96163]	[5.00937]
C	-0.00017	0.00004	-0.00099	0.00075	-0.00410
	[-0.02078]	[0.03496]	[-0.31917]	[0.32092]	[-0.37743]
R-squared	0.08602	0.09371	0.30787	0.14766	0.28722
F-statistic	1.41170	1.55103	6.67210	2.59851	6.04428
Sum sq. resids	0.58864	0.00880	0.08324	0.04761	1.02528
Akaike AIC	-2.12245	-6.32588	-4.07854	-4.63721	-1.56754
Schwarz SIC	-1.93665	-6.14008	-3.89274	-4.45141	-1.38173

Notes:

1) [ ] shows 't' values of "t" statistics
2) * shows the coefficient significantly different from zero at 0.01 percent probability level;
3) ** shows the coefficient significantly different from zero at 0.05 percent probability level;
4) *** shows the coefficient significantly different from zero at 0.10 percent probability level;

Table 6: Results of General error correction model, 2003 – 2011, Dependent Variable: DlnSMP

Variable	Coefficients	Std. Errors	*t* -Statistics	*p* -values
DlnSMP(-1)	-0.08441	0.11219	-0.75231	0.45410
DlnSMP(-2)	0.08651	0.11186	0.77337	0.44160
DlnINF	-1.75431	0.98589	**-1.779417*** **	0.07900
DlnINF(-1)	2.15188	1.08638	**1.980783** **	0.05110
DlnINF(-2)	-0.02933	1.07509	-0.02728	0.97830
DlnMSY	-0.32976	0.32392	-1.01804	0.31180
DlnMSY(-1)	0.47212	0.32514	1.45206	0.15040
DlnMSY(-2)	0.27729	0.27245	1.01778	0.31190
DlnEXR	0.55743	0.39890	1.39744	0.16620
DlnEXR(-1)	0.87023	0.39272	**2.215914** **	0.02960
DlnEXR(-2)	-0.11272	0.40143	-0.28079	0.77960
DlnINT	0.02234	0.08347	0.26760	0.78970
DlnINT(-1)	0.03692	0.09421	0.39186	0.69620
DlnINT(-2)	0.04153	0.08348	0.49751	0.62020
DUMMY	-0.04461	0.02324	**-1.919178*** **	0.05860
ECT(-1)	-0.22007	0.06754	**-3.258286***	0.00170
C	0.00813	0.00904	0.89882	0.37150
AIC = -2.115618	SIC = -1.661514	F-statistic = 1.747636		
Diagnostic Tests:				
R^2	26.14%			
$\check{R}^2$	11.18%			
DW-d	1.9817			
JB	7.66920 [0.02161]			
AR[2]	0.04744 [0.95370]			
ARCH[2]	0.32914 [0.72040]			

Notes:

1) *, **, *** indicates significance at 1%, 5% and 10% respectively;

2) AIC is the Akaike Information Criterion;

3) SIC is the Schwarz Information Criterion;

4) JB is the Jarque-Bera statistic for testing normality;

5) AR is the lagrange multiplier test of second order serial correlation;

6) ARCH is the Autoregressive Conditional Heteroscedasticity test.

Figure 1: Plot of Cumulative Sum of Recursive Residuals

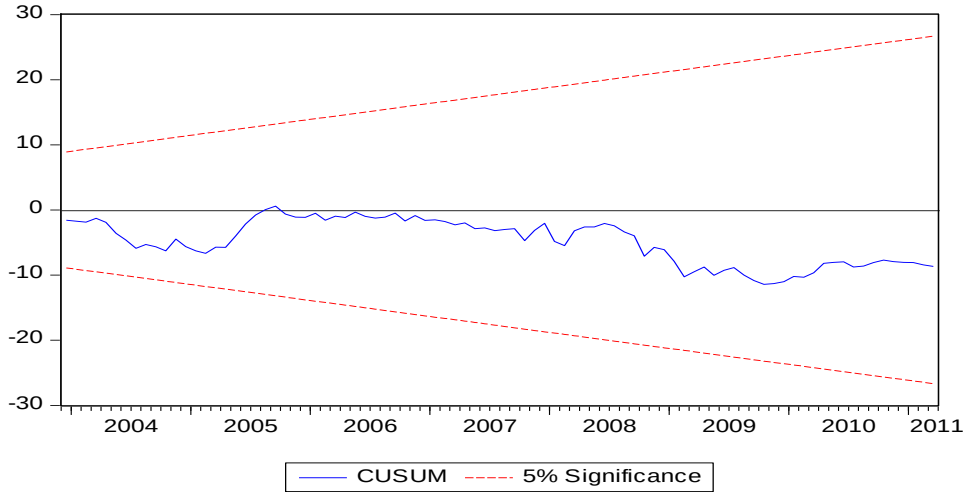

Figure 2: Plot of Cumulative Sum of Squares of Recursive Residuals