Dynamic relationships between stock market performance and short term interest rate Empirical evidence from Sri Lanka

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18 August 2012

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Abstract— *This study examines the dynamic relationships between stock market performance and the interest rates in Sri Lanka during June 2004 to April 2011. We use all share price index in the Colombo stock exchange as a measure of stock market performance indicator and Sri Lanka interbank offer rate as a measure of interest rate. We employ some conventional time series econometric techniques namely Unit root test, cointegration test, vector auto correction model (VECM), Granger-Causality test and Impulse response functions (IRF) to trace out the relationships between stock market index and interest rate. The findings of interest include stock market performance is negatively associated with interest rate in the long run while no causal relationship is found in the short run.*

***Keywords*— Time Series, Colombo Stock Exchange, Interest Rate, VECM, Cointegration**

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1. Introduction

Stock market plays a major role in providing capital requirement of the companies. Issuing shares to ordinary public is one of the most cost effective ways for the long term fund requirements. Many researchers find that economic growth and development of a country depends on investments which requires long term funding. Therefore, stock market plays a very important role of a country's economic growth and development (Aydemir and Demirhan, 2009). Stock market also helps in distributing nation's wealth by enabling wide ownership of public company stocks. Investors can buy shares of publicly listed companies which enable them to be the owners of the business and earn share of profits according to their invested capital. Stock market performance depends on many factors. It is highly volatile to countries' economic and political conditions. If the overall macroeconomic condition of a country is good, then the stock market usually has better returns and if the overall macroeconomic condition of a country is poor, then the stock market returns are usually not good. The political situation of the country is also very important factor that affect stock market performance. For example, if political situation in one country is unstable then investors are reluctant to invest in the stock market which may cause stock prices to go down. Theoretically, the interest rate has a negative impact on stock market performance because an increase of interest rate would avoid investors making high risk stock market investments compare to low risk interest bearing security investments such as fixed deposits, savings certificates, treasury bills etc (French et al., 1987). In other words, demand for high risk stock market investments would fall if the interest rate was high. Consequently, fall in demand for shares would eventually reduce its prices. In contrast, lower interest rate would cause opposite effect such that higher demand for stock investment and increase of share prices. On the other hand, Central Banks usually uses interest rate as a tool to curb inflation of the country. If the Central Bank changes the interest rates in order to curb the inflation, it would indirectly affect the stock market performance and eventually would have an impact on overall economic development of the country. Thus, determination of ideal interest rate is very important policy decision that one country has to do regularly. Therefore, Central Bank monetary board gathers every month and decide the appropriate interest rates in the country.

Many economists believe that stock market performance is highly influenced by macroeconomic fundamentals. The relationship of stock market performance and macroeconomic variables such as interest rates, exchange rates, GDP and the money supply has been investigated by many researchers (Poon and Taylor, 1991; Gan et al., 2006; Husni et al., 2010; Rahman et al., 2009). Most of these studies are based on well-established stock markets such as the US, UK and Japan (Chen et al., 1986; Poon and Taylor, 1991; Mukherjee and Naka, 1995) and some are related to emerging stock markets (Arango et al., 2002; Gunasekarage et al., 2004; Aydemir and Demirhan, 2009). Few related papers in a Sri Lankan context, focuses on examining impacts of macroeconomic variables on the stock market performance (Samarakoon, 1996; Gunasekarage et al., 2004; Wickramasinghe, 2011). However, these studies do not specifically focuses on exploring the dynamic relationships between stock market performance and interest rate. Moreover, previous studies use quarterly or monthly time series data. In this paper, we explore the dynamic relationship between the all share price index (ASPI) as a measure of performance of the Colombo Stock Exchange (CSE) in Sri Lanka and Sri Lanka interbank offer rate (SLIBOR) as a measure of prevailing interest rate decided by central bank of Sri Lanka using daily time series data over the period of 2004 June to 2011 April. We estimate relationship between stock market performance and interest rate using time series econometric analysis. Specifically, we use conventional unit root test, Johansen cointegration test, vector error correction model (VECM) in order to examine the relationship of stock market performance and interest rate. In addition, we use impulse response function (IRF) and Granger-Causality test analysis to explore the short run dynamic relations of the stock market performance and interest rate.

The rest of this paper is structured as follows. Section 2 reviews the related previous literature. Section 3 describes the data and presents the descriptive analysis. Section 4 explains the econometric methodology. Section 5 presents the estimation results and discuses the results. Finally, section 6 concludes the paper.

2. Literature Review

The effects of macroeconomic variables such as interest rates, inflation, money supply, exchange rates on stock market returns is widely discussed topic in financial and monetary economics literature. The relationship between the stock market performance and the interest rate is traced back to Friedman's money demand function (Osuagwu, 2009). Friedman (1956) theoretically illustrated that an agent's decision of portfolio allocation such as equity investments has an impact on savings-consumption decision and it is determined by the interest rates changes. On the other hand, researchers also make an effect to test rational expectation models of long term asset prices which state that the difference between the rationally expected returns of one set of assets and the another set of assets called "risk premium" is equal to a constant over some time interval (Fama and Schwert, 1977; Campbell, 1987). Fama and Schwert (1977) considered stock market returns and Treasury bill rate as the two set of assets and showed that the expectation model for stock returns and interest rate is strongly rejected using US post war data. Campbell (1987) also rejected the rational expectation theory and showed that term structure of interest rates predicts stock returns. His results reveals that risk premium on stocks seem to move closely together with long term 20 year treasury bonds while relationship between risk premium on stocks and short term treasury bill is somewhat independent. Arango et al. (2002) empirically explored the relationship of the share prices on the Bogota stock market and the interest rate measured as the interbank loan interest rate in Colombia. Their results reveal an inverse and non linear relationship between share prices and the interest rates.

Arbitrage Pricing Theory (APT), introduced by Ross (1976), led to link stocks returns to economic variables. Chen et al. (1986) explored the influence of several economic variables such as industrial production, inflation, and spread of long and short term interest rates on US stock returns using APT. Their findings indicate some of the economic variables are positively associated with expected stocks returns while some variables are negatively related to the expected stock returns. Cointergration analysis, vector auto regressive (VAR) model and vector error correction (VECM) model analysis are extensively used to empirically trace out impacts of macroeconomic variables on stock market performance recently. For instance, Mayasami and Koh (2000) examined the long term relationships between the Singapore stock index and selected macroeconomic variables by estimating VECM. Their results reveal that Singapore stock market is significantly sensitive to the long and short term interest rates and exchange rates. Mukherjee and Naka (1995) also employed the cointegration test and VECM analysis and in order to figure out the relationships between the Japanese stock market and selected macroeconomic variables. According to their results, Japanese stock market is cointegrated with exchange rate, money supply, inflation rate, industrial production, long term government bond rate and the short term call money rate.

In a Sri Lankan context, few authors studied the relationships between the Sri Lankan stock market namely Colombo Stock Exchange (CSE) and economic variables (Samarakoon, 1996; Gunasekarage, 2004; Wickramasinghe, 2011). One such study by Gunasekarage et al. (2004) examined the impacts of macroeconomic variables namely money supply, treasury bill rate (as a measure of interest rates), consumer price index (as a proxy for inflation) and exchange rate on stock market performance index using monthly data for the above variables. Their results from estimating VECM model reveal that the rate of inflation, the money supply and the Treasury bill rate have statically significant influence on the stock market index. Wickramasinghe (2011) extended the work of Gunasekarage et al. (2004) by adapting a sophisticated unit root test, including more economic variables and exploring both short term and long term causal relationship among the stock market performance and the macroeconomic variables. His results suggest that there are both short run and long causal relationship among stock prices and macroeconomic variables.

3. Data and descriptive analysis

3.1 Data

The study based on all share price index (ASPI) of the Colombo stock exchange and the Sri Lanka interbank offer rate (SLIBOR). I use ASPI data as the stock market performance indicator and the SLIBOR data as the prevailing interest rates. The ASPI is measured using total market capitalization and the quantity of total issued shares in the Colombo stock exchange. SLIBOR is the interest rate that commercial banks offer money to other banks for tenures of overnight, 1 week, 1 month, 3 months, 6 months and 12 months. SLIBOR data are calculated and published daily by the Central Bank of Sri Lanka taking into account the contributions made by commercial banks in Sri Lanka. The commercial banks' deposit interest rates are mostly depends on SLIBOR. In this paper, I only use one month SLIBOR data. This study uses daily time series ASPI and SLIBOR data for nearly 7 year period starting from 2004 June to 2011 April.

3.2 Descriptive Analysis

Fig. 1. shows the performance of the all share price index (ASPI) of the CSE and the SLIBOR from 2004 June to 2011 April. In order to show the relationship between ASPI and SLIBOR in a same graph, both data are converted into the logarithm form. There appears to have an inverse relationship between stock market performance and the prevailing interest rate which can be more clearly seen since 2009. It is expected that the stock market performs well under the low interest rates.

However, we can see that the growth of stock market indexes is really high after 2009. This is because in May 2009, Sri Lankan government succeeds in ending civil war which existed for over two decades. After the civil war ended in 2009 May, stock market indexes have grown significantly. In both 2009 and 2010, CSE was one of the world's best performing market. For instance, ASPI was reported around 2000 in early 2009 and has increased to over 7000 in early 2011. Both local and foreign Investors were highly active in the market on this period. Thus, not only the low interest rate condition but also other political factors might have attributed to the stock market performance since mid 2009.

In Table 1, I present the descriptive statistics of the variables. There are 1637 observations in the sample period of June 2004 to April 2011. According to the table 1, mean value of one month SLIBOR is 12.71%. This is quite high value for a developing country. However, during the period of 2004 to 2011, Sri Lankan economy had ups and downs due to the global economic recession as well as domestic unstable political conditions. In the period of early 2007 to mid 2009, interest rates were really high. For example, maximum SLIBOR value 24.83% is reported in March 2007. Sri Lankan government has increased interest rates to slow down the high inflation reported in this period. Inflation was really high due to two main reasons. First, government expenditure on civil war was at peak in this period and government printed money to finance government war expenditure. Thus, demand-pull inflation had significantly increased. Second, during this period, Sri Lankan commodity price levels had increased significantly due to the rapid increase of world oil prices. As a result, cost-push inflation had also been increased. However, after end of oil price crisis as well as Sri Lankan civil war, inflation rate as well as interest rates had gradually come down.

During the sample period, we find that Sri Lankan stock market is highly volatile because standard deviation of ASPI is quite high. According to the table 1, mean value of the ASPI is 2851.8 and the standard deviation is 1502 during the sample period indicating highly volatile stock market performance. For instance, minimum value of ASPI is reported as 1282 in 2004 and maximum value is reported as 7811 in early 2011. Stock market volatility may be mainly attributed to domestic political and economic conditions.

4. Methodology

This paper employs the time series econometric techniques in order to quantify the relationship between stock market performance and interest rate. We use following general model.

$$\log(ASPI_t) = \alpha + \beta \log(R_t) + \varepsilon_t \qquad (1)$$

Where, $ASPI_t$ is the stock market all share price index, R_t is the Sri Lanka interbank offer rate for one month and ε_t is the error term.

First, we conduct unit root test to examine the stationarity of the variables. Second, we employ the Johansen cointegration method to examine any long run cointegration relationship between stock market performance and interest rate. Third, we estimate vector error correction model (VECM). Fourth, we run the granger causality test to determine any short run relationship of the variables. Finally, the impulse response analysis is conducted to examine the dynamic relationship between stock market performance and interest rate.

4.1 Unit root test

We use Augmented Dicky-Fuller (ADF) test to examine the presence of unit roots in the two variables. ADF test is an extended version of the original test of Dicky and Fuller (1979) to control for the serial correlation of the error term (Dicky and Fuller, 1981; Stata Corp., 2009). ADF test consider a model of following form.

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \gamma t + \sum_i^k \delta_i \Delta Y_{t-i} + \epsilon_t \qquad (2)$$

Where, ΔY_t is the first difference time series variable and ϵ_t is a white noise error term. Testing procedure of ADF test is examination of the null hypothesis of $\beta = 0$ which is equivalent to Y_t is a non-stationary process. Moreover, ,we also run Phillips and Perron (1988) unit root test and Ng and Perron (2001) unit root test in order to complement the robustness of the ADF test .

4.2 Johansen cointegration test

In order to examine the cointegration relationship between the stock market performance variable and the interest rate variable, we employ widely used Johansen cointegration test. If we find a cointegration between the stock market performance variable and interest rate variable, it implies that there is a long run relationship between stock market performance and interest rate. Johansen cointegration testing method is based on a following model (Johansen, 1988, 1991).

$$\Delta Y_t = \sum_{i=1}^{q-1} \Pi_i \Delta Y_{t-i} + \Pi_q \Delta Y_{t-q} + \mu + v_t \qquad (3)$$

Where, Y_t is a $n\ x\ 1$ vector of variables, Π_q is a $n\ x\ n$ matrix of rank $r \leq n$, μ is a $n\ x\ 1$ vector of constant term and v_t is a $n\ x\ 1$ vector of residuals. We test for null hypothesis of $H_0 = \Pi_q = \alpha\beta'$. Where, α represents speed of adjustment parameters and β includes r cointegration vectors. We use likelihood ratio (LR) test developed by Johansen to test the null hypothesis (Rahman et al. 2009).

4.3 Vector error correction model

If we identify a cointegration relationship, we need to estimate a VECM. In practice, we consider a following general vector auto regressive (VAR) model with P lags.

$$Y_t = v + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_p Y_{t-p} + \varepsilon_t \qquad (4)$$

Where, Y_t is a $K \times 1$ vector of variables, v is a $K \times 1$ vector of parameters. $A_1 - A_p$ are $K \times K$ matrices of parameters, and ε_t is a $K \times 1$ vector of disturbances. We can rewrite VAR model as a following VECM by using some algebra (Stata Corp., 2009).

$$\Delta Y_t = v + \Pi Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t \qquad (5)$$

Where, $\Pi = \sum_{j=1}^{j=p} A_j - I_k$ and $\Gamma_i = -\sum_{j=1+1}^{j=p} A_j$. The v and ε_t in (4) and (5) are identical.. In this paper, we use Stata software package which uses maximum likelihood (ML) methods to estimate the parameters of the VECM model.

4.4 Granger causality test

To examine any short run causal relationship between stock market performance and interest rate, we use Granger causality test. If we assume two time series variables X_t and Y_t which are I (1) and cointegrated, Granger causality test is based on following equations (Gan et al., 2006).

$$\Delta X_t = a_x + \sum_{i=1}^{k} \beta_{x,i} \Delta X_{t-i} + \sum_{i=1}^{k} \gamma_{x,i} \Delta Y_{t-i} + \varphi_x ECT_{x,t-i} + \varepsilon_{x,t} \qquad (6)$$

$$\Delta Y_t = a_y + \sum_{i=1}^{k} \beta_{y,i} \Delta Y_{t-i} + \sum_{i=1}^{k} \gamma_{y,i} \Delta X_{t-i} + \varphi_y ECT_{y,t-i} + \varepsilon_{y,t} \qquad (7)$$

Where, ΔX_t and ΔY_t are the first difference of the variables. φ_x and φ_y are the parameters of the error correction term (ECT). It measures the error correction mechanism that drives the X_t and Y_t back to their long run cointegration equilibrium relationship. We test null hypothesis of $H_0 : \sum_{i=1}^{k} \gamma_{x,i} = 0$ in equation (6) to examine any causal relationship between lagged terms of ΔY and ΔX. Similarly, we test null hypothesis of $H_0 : \sum_{i=1}^{k} \gamma_{y,i} = 0$ to find any casual relationship between lagged terms of ΔX and ΔY.

4.5 Impulse response analysis

Impulse response function (IRF) analysis can be used to find short run interrelationship among variables. IRF shows the responses of all variables due to the one unit shock to the one variable in the model. We normally use graphs to show the impulse response functions. The Y axis of the graph shows the impulse responses and periods from the initial shock represent the X axis. An each impulse response can be interpreted as a following time specific partial derivatives of the vector moving average (VMA) function (Gan et al., 2006; Enders, 1995).

$$\phi_{jk}(i) = \frac{\partial X_{ji}}{\partial e_k} \qquad (8)$$

where, X is a VMA function and $\phi_{jk}(i)$ measures the change in the j^{th} variable in period t due to a unit shock to the k^{th} variable in the present period.

5. Estimation results

5.1 Unit root test

Table 2 shows the unit root test results of the variables using ADF test, Phillips & Perron and Ng & Perron tests. They reveal that both variables are non-stationary in levels as it contains one unit root because we fail to reject null hypothesis of containing a unit root in both 1% and 5% significance level. However, results in Table 2 also suggest that both variables are stationary at first difference even in 1% level of significance. Thus we conclude that both variables are I (1) variables.

5.2 Johansen cointegration test

Since both variables are I (1) variables, first we use Johansen co-integration test in order to examine long run relationship between these two time series. Results of Johansen cointegration test in table 3 suggest that two variables are cointegrated at 5% significant level since we fail to reject null hypothesis when rank is one but reject at rank is zero. Accordingly, stock market performance and interest rate seem to have long run equilibrium relationship.

5.3 Vector error correction model

Having established that stock market performance and interest rate are cointegrated, we need to estimate the vector error correction model which will react to short run deviations from the long run equilibrium. The estimation results of the VECM are shown in table 4 and table 5. According to table 4, we find following stationary long run equilibrium equation between stock market performance and interest rate as in equation (2).

$$\log(ASPI) + 11.11 \log(R) - 37.83 \qquad (2)$$

The coefficient of the log of one month LIBOR rate is statistically significant and positive indicating inverse long run cointegration relationship between stock market performance and interest rate.

On the other hand, if there is short run disequilibrium of this long run equilibrium condition, only the stock market performance responds to the prevailing interest rate because table 5 results shows that only the short run adjustment parameter for stock market performance variable is statistically significant. The estimate of the short run adjustment parameter for the stock market performance variable is negative. Thus, when the stock market growth is too high, it quickly falls back to equilibrium level.

Next we examine the specification of the model. First, we investigate the stability of the VECM. Fig. 2 shows the eigenvalues of the companion matrix of VECM. According to Fig. 2, we find that all the eigenvalues are inside the unit cycle indicating correct specification of the model. Second, we test for the serial correlation in the residuals. According to the table 6, we failed to reject the null hypothesis of no serial correlation in the residuals. Thus, we can confirm that our model has no serial correlation in the residuals.

5.4 Granger causality test

After concluding long run cointegration relationship between stock market performance and interest rate, we now examine short run dynamics using Granger-Causality test. In table 7, we present the Granger Causality test result including 4 lags. We find no short run Granger Causality between stock market performance and interest rate in both directions because results in table 7 indicate failure to reject null hypothesizes.

5.5 Impulse response analysis

Finally, we conduct impulse response analysis in order to trace out dynamic response of stock market performance and interest rate owing to the unanticipated stock market and interest rate shocks. Fig. 3 illustrates impulse response function of stock market performance to interest rate shocks and interest rate performance to stock market shocks. The stock market performance gradually decreases as given interest rate shock implies a shock to interest rate has negative effect on stock market performance. In contrast, interest rate falls following stock market performance shock for first two days then increase next two days finally it is stable forever.

It can be explained that if the interest rate was high investors would leave from high risk stock market to invest in low risk bank deposits. Likewise, if the interest rate is low, investors may prefer to invest in stock market. Moreover, company profits will be low under the high prevailing interest rate condition because companies have to pay higher interest costs for their debt. As a result investors reluctant to invest in low profitable company equities. On the other hand, a shock to a stock market performance has also a negative impact on interest rate concluding an inverse relationship between stock market performance and interest rate.

6. Conclusions

This article sheds light on dynamic relationships between stock market performance and the interest rates in Sri Lanka during June 2004 to April 2011. Using daily data, we employ time series econometric techniques namely Unit root test, cointegration test, VECM, Granger causality test and IRF in order to trace out dynamic relationships between stock market returns and interest rate. The findings of interest are follows. Unit root tests result concludes that both stock market performance and interest rate variables are non stationary and order of integration of I(1). The results of the Johansen cointegration test indicate that there is a long run cointegration movement between stock market performance and short term interest rate. Estimating a VECM model, we find that negative long run relationship between stock market returns and short term interest rate which is consistent with theoretical prediction. However, results of the Granger causality test indicate there are no short run causal relationship between stock market returns and interest rate. In addition, IRF analysis reveals that permanent negative impact on stock market performance as a result of a shock to the short term interest rate.

Although we have found a negative long run relationship between stock market performance and short term interest rate, prevailed socio-economic climate during the period of the study might have an influence on the results. During the sample period from June 2004 to April 2011, Sri Lanka underwent major political and economic changes. Sri Lankan government armed forces and northern rebels called Liberation Tigers for Tamil Eelam (LTTE) had been engaging fierce military confrontation for nearly three decades. However, after the breakdown of final phase of peace negotiations between Sri Lankan government and LTTE in 2006, Sri Lankan military forces launched a massive military operation against LTTE and eventually defeated LTTE in May 2009. Since then Sri Lankan stock market performed exceptionally and reported as one of the best performing stock market in 2009 and 2010. On the other hand, high level of cost push inflation due to massive military expenditure and high level of oil import cost in 2008 significantly declined after ending civil war in May 2009. Consequently, Central Bank of Sri Lanka decreases the interest rates significantly. Thus, extremely bullish stock market performance since mid 2009 may be attributable for these economic and political changes.

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Table 1: Descriptive statistics of the variables

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
ASPI	1637	2851.81	1502.97	1282.47	7811.82
1 month SLIBOR	1637	12.71 %	3.92	8.01	24.83

Source: Author’s calculation using Colombo Stock Exchange and Central Bank of Sri Lanka data

Table 2: Unit Root Test

Variable	ADF test statistic		Phillips and Perron test statistic		Ng and Perron test statistic	
	Level	First Difference	Level	First Difference	Level	First Difference
log (ASPI)	-0.429	-36.478**	-0.322	-36.767 **	-1.298	-4.173 **
log (R)	-1.000	-32.405**	-1.034	-31.673 **	-0.281	-7.700 **

Notes:

1. ** indicates statistically significant at 1% level and * indicates statistically significant at 5% level
2. ADF and Phillips Perron statistics are when model including both constant and time trend
3. Critical values for ADF test and Phililips and Perron test at 5% and 1% significance level are -3.410 and -3.960.
4. Critical values for Ng Perron test are chosen by selecting optimal lag length.

Table 3: Johansen cointegration test

Rank	Trace Statistic	5% Critical Value
0	16.9898	15.41
1	0.2183*	3.76
2	-	-

Notes: * indicates statistically significant at 5% level

Table 4: Cointegrating equations

Variable	Coefficient	Standard Error	P-Value
Log (ASPI)	1	-	-
Log (R)	11.10909 **	2.8015	0.000
Constant	-37.8288	-	-

Notes:

1. ** indicates statistically significant at 1% level. z denotes t statistics.
2. Optimal lag length of 3 is chosen using Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (SBIC), and the Hannan and Quinn information criterion (HQIC).

Table 5: Vector Error Correction Model

Dependant Variable	Explantory Variable	Coefficient	Standard error	P- Value
Dlog ($ASPI_t$)	ECT_{ASPI}	-0.0003**	0.0001	0.000
	log ($ASPI_{t-1}$)	0.0909**	0.0247	0.000
	log ($ASPI_{t-2}$)	0.0254	0.0247	0.304
	log (R_{t-1})	0.0051	0.0171	0.763
	log (R_{t-2})	-0.0285	0.0171	0.095
	Constant	0.0002	0.0004	0.592
Dlog (R_t)	ECT_R	-0.0002	0.0001	0.189
	log ($ASPI_{t-1}$)	-0.0349	0.0352	0.322
	log ($ASPI_{t-2}$)	0.0030	0.0352	0.932
	log (R_{t-1})	0.2645 **	0.0242	0.000
	log (R_{t-2})	-0.2072 **	0.0242	0.000
	Constant	-0.0004	0.0005	0.468

Notes:

1. ** indicates statistically significant at 1% level
2. D denotes first difference of the variables
3. ECT denotes error correction term.
4. t-1 and t-2 represent the first lag and 2nd lag of the variables.
5. Optimal lag length of 3 is chosen using Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (SBIC), and the Hannan and Quinn information criterion (HQIC).

Table 6: Serial correlation test in the residuals

Lag	Chi squared value	P-value
1	2.6420	0.6194
2	5.4780	0.2417

Table 7: Short run Granger Causality

Null Hypothesis	Chi-squared	p-value
Stock market performance does not granger cause interest rates	0.98	0.6120
Interest rate does not granger cause stock market performance	2.80	0.2471

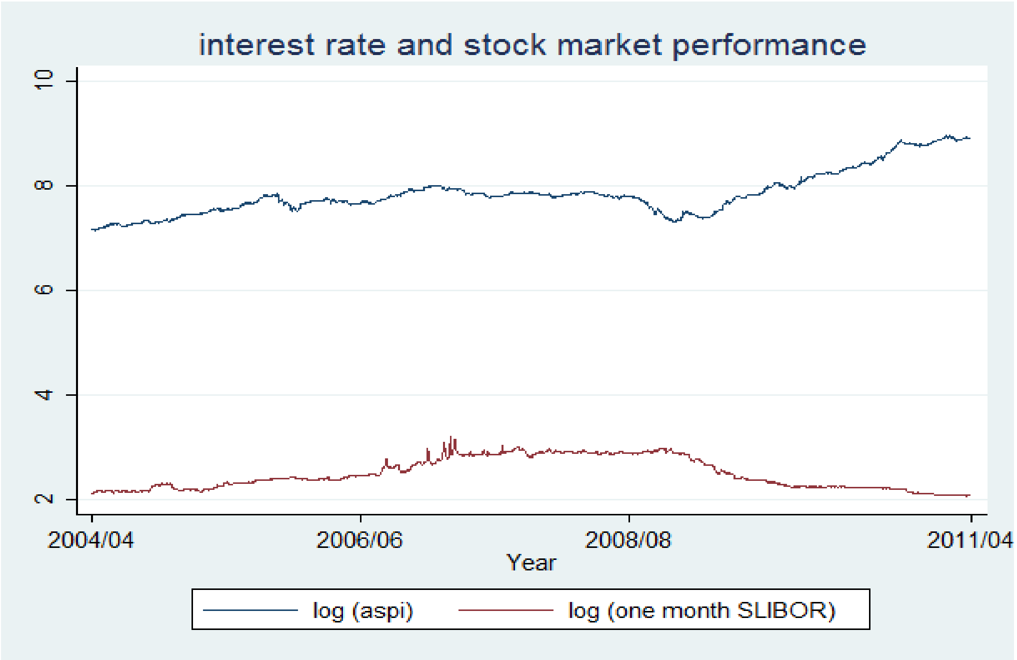

Fig. 1. Stock market performance in Sri Lanka

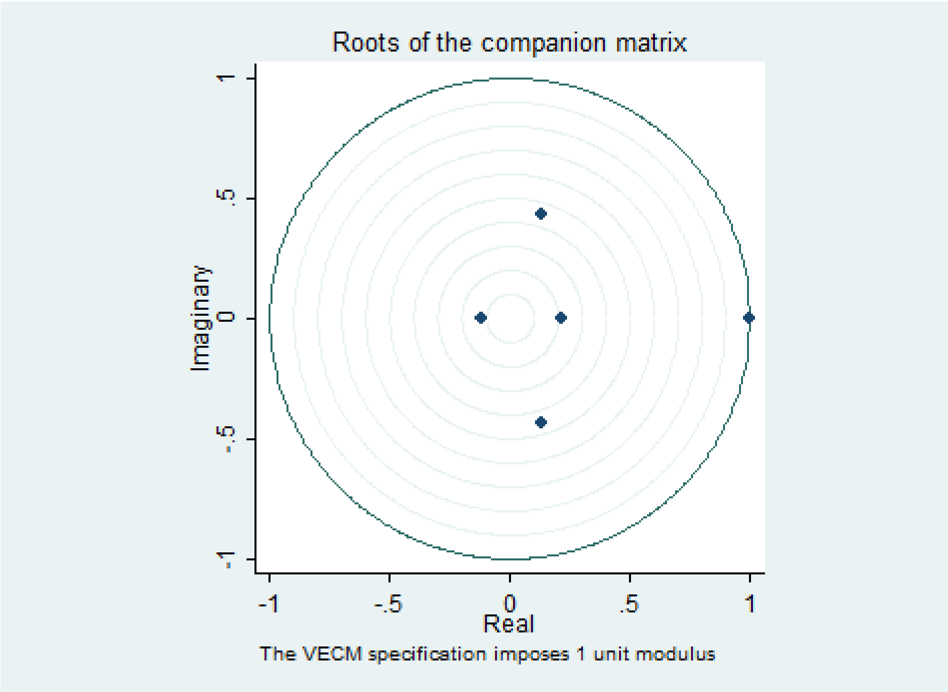

Fig. 2: Stability of VECM

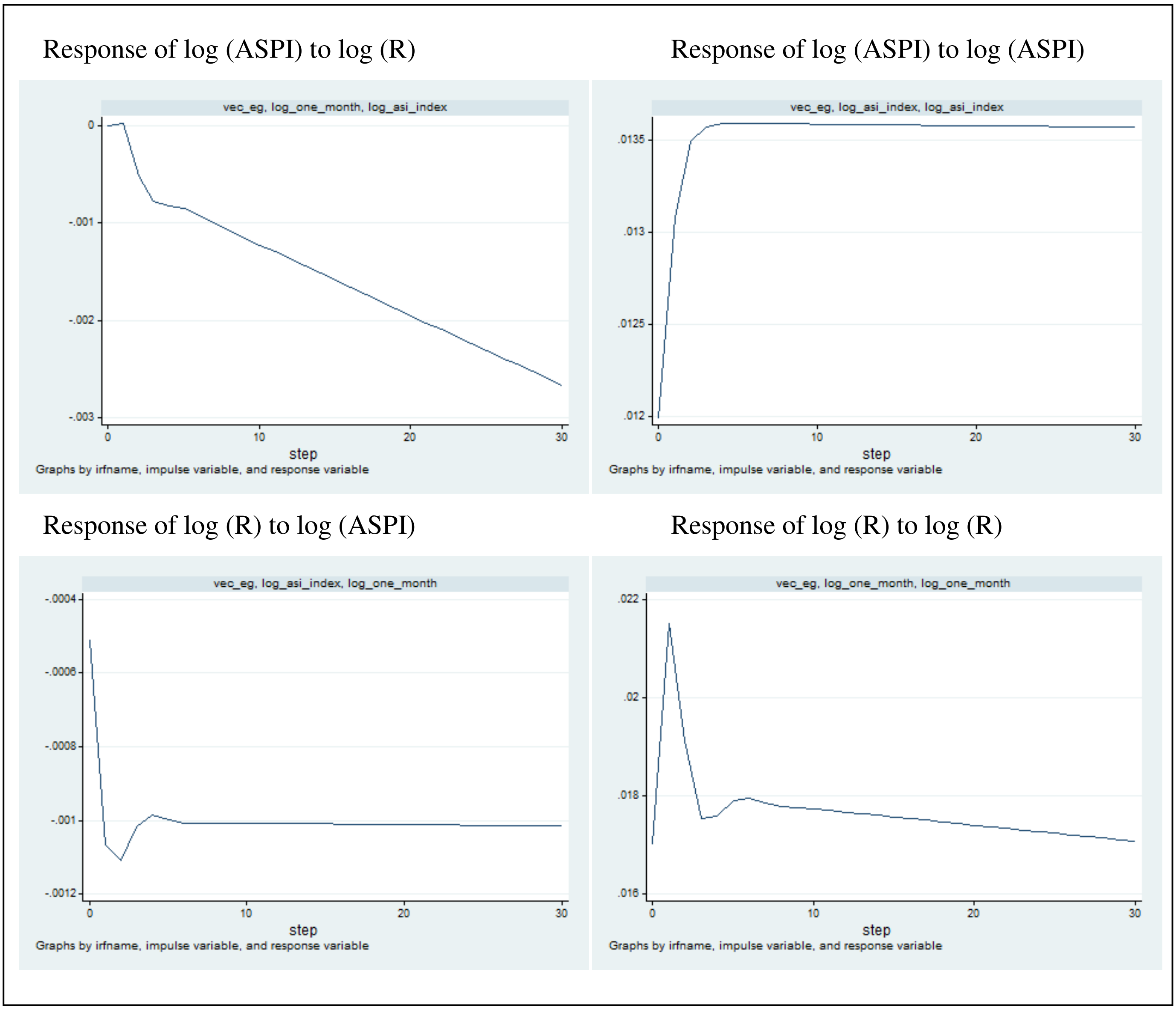

Fig. 3: Impulse response functions