CONTRIBUTION OF MACROECONOMIC FACTORS ON THE STOCK MARKET PERFORMANCE IN SRI LANKA

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ABSTRACT

The main aim of this research study is to analyze the connections that exist amongst the all share price index of Colombo Stock Exchange (CSE) and four major macro economic factors: Inflation, Exchange Rate, Money Market Rate and Money Supply of Sri Lanka. To study this research the data were collected monthly basis from January 2001 to December 2011 time periods. Co-integration analysis for macro economic factors and all share price index of stock market were carried out to test for the existence and Vector Error Correction Model (VECM), indeed extent of the co-movement that is evident of co-integration can be viewed as the statistical expression of the nature of equilibrium relationships, with co-integrated variables sharing common stochastic trends. The Johansen co-integration test and VECM and its estimation procedures are discussed in this paper. Long and short run relationships exist among the Stock price index and macroeconomic variables. The results of the study will aid us to gain insight into how all share price index of CSE of Sri Lanka co-integration contributes to portfolio diversification strategy. The results have implication for investors, both domestic and international.

Key Words: *Co-integration Test, ADF-Unit Root Test, Colombo Stock Exchange, Macro Economic Variables, Vector Error Correction Model.*

Introduction

CSE operates the only share market in Sri Lanka and is responsible for providing a transparent and regulated environment where companies and investors can come together. The CSE is a company that is limited by guarantee established under the Laws of Sri Lanka. At present the CSE functions as a market operator and through its fully owned subsidiary, Central Depository Systems (Pvt.) Limited (CDS), acts as a clearing and settlement system facilitator. The CSE has two main price indices, the All Share Price Index (ASPI) and the S&P Sri Lanka 20 Index (S&P SL 20). These index values are calculated on an on-going basis during the trading session, with the closing values published at the end of each session.

An efficient capital market is one in which security prices adjust rapidly to the arrival of new information and therefore, the current prices of securities reflect all information about the security. What this means, in simple terms, is that no investor should be able to employ readily available information in order to predict stock price movements quickly enough so as to make a profit through trading shares. Moreover, economic theory suggests that stock prices should reflect expectations about future corporate performance and corporate profits generally reflect the level of economic activities. If stock prices accurately reflect the underlying fundamentals, then the stock prices should be

employed as leading indicators of future economic activities and not the other way around. Therefore, the causal relations and dynamic interactions among macroeconomic variables and stock prices are important in the formulation of the nation's macroeconomic policy.

To achieve the goal of the research study this research paper is organized into five sections. Literature reviews are given in section two, section three described the methodology of the research study, in section four results and discussions are given and the last section conclusions and recommendations are given.

Literature Review

History has shown that the price of all share price index and other financial assets are an important aspect of the dynamics of economic activity, performing a vital role in national economies of Sri Lanka. Stock prices can be an indicator of social mood and are used as a leading indicator of the real economic activity. Rising share prices, for instance, tend to be associated with increased business investment and vice versa. Therefore, economic policy makers keep an eye on the control and behavior of the stock market, as its smooth and risk free operation is essential for economic and financial stability. This study suggests that the movement of stock market indices is highly sensitive by the changes in the macroeconomic variable. The macroeconomic factors are the major determinants of the growth of an economy in Sri Lanka.

Addy et al., (2014), identify the relationship between macroeconomic variable and Ghana stock exchange which was revealed that there is a long run relationship between some of the macro-economic variables and the stock market. Money supply is statistically significant at 1% level in explaining the variations in the performance of Ghana stock exchange. With these results it is important to highlight that there is the need to implement prudent macroeconomic policies in order for the country to derive maximum benefits from stock markets. Chandni et al., (2012) investigated that the relationship between Indian stock exchange and macroeconomic factors which show that there is a positive relation with call rate (interest rate) and negative relation with exchange rate. Anokye and George (2008) studied the role of macroeconomic variables in stock market movement in Ghana which was revealed that there is long run relationship between the variables using Johansen's multivariate co-integration tests. And they found inflation to positively relate to Databank Stock Index.

Caroline et al., (2011) studied the relationship between stock market, expected inflation rate, unexpected inflation rate, exchange rate, interest rate and GDP in the case of Malaysia, US and China. They found that there is a long run equilibrium relationship between the variables. The results of VEC are no short run relationship between the stock market, expected inflation, exchange rate, unexpected inflation, interest rate and GDP for Malaysia and US. However, China's VEC result show there is a short run relationship between expected inflation rates with China's stock market. Omran and Pointon (2001) analyzed short-run and long-run relationships between the inflation rate and the performance of the Egyptian stock market. The results revealed an expected behavior for the stock market response to the decrease in the inflation rate. From this analysis they concluded that the inflation rate, clearly, has had an impact upon stock market performance in terms of market activity and market liquidity. In fact, this relationship was negative and in the long and short-run for all market activity and market liquidity variables except for the number of traded companies, in which case this relationship was in the long-run only.

Wickremasinghe (2006) examined the relationship among stock price and six macroeconomic variables in Sri Lanka. The results of the Johansen co-integration test indicate that there is one co-integration

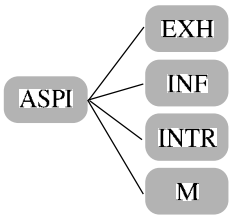
relationship among the stock price and macroeconomic variables. Therefore, researcher proceeded to estimate the error correction model to examine short-run and long-run relationship. This reveals that there are five long-run relationships and two short-run relationships among the variables. Money supply and US dollar exchange rate highly influence on stock market operation. Tahir and Wong (2004) studied relationship between four stock indices and exchange rate in Karachi Stock Exchange (KSE), the results obtained by using Johanson's co-integration technique that there is no co-integrating relationship among the variables. Therefore, a long-run relationship between stock indices and exchange rate does not exist in their analysis, that is stock indices and exchange rate do not move together in the long run association of KSE. The exchange rate which indicates the movement of currency affects stock prices in a way similar to the inflation variable. Depreciation of the local currency makes import expensive compared to export, leading to increased production cost of import companies. Mukherjee and Naka (1995) also found that exchange rate positively relates to stock prices in Japan and Indonesia.

According to Nissim and Penman (2003), various studies have acknowledged that stock returns and interest rates are negatively related. They examined the relationship between a change in the interest rate, earnings and stock return using data from the US and found that unexpected changes in interest rates are positively related to unexpected earnings in the year of the interest rate change and in the following year. This relationship is due to a positive association between interest rates and operating income.

Keray (2009) investigated that the interrelationship between stock prices and monetary indicators for Jamaica. The Johansen co-integration test was used to determine the existence of a long term relationships between stock prices and monetary variables such as money supply, interest rate, inflation rate and the exchange rate. The variables were found to be co-integrated with significant relationships researcher suggests that the JSE main index is positively influenced by the inflation rate and money supply and negatively by the exchange rate, interest rate. The relationship between money supply and the stock market has been investigated empirically.

Methodology

In the process of operationalisation the concept which could be visualized by the researchers is as follows.



Objective of the Research Study

The objective of this study is to analyze the connections that exist amongst the all share price index of CSE and four major macro economic factors: Inflation, Exchange Rate, Money Market Rate and Money Supply of Sri Lanka.

Model Specification

The model for this study can be expressed in equation (1) and can represent this function in a mathematical linear model as shown in equation (2).

$$ASPI=fEXH,INF,MMR,M \quad (1)$$

$$ASPIt=\beta0+\beta1EXHt+\beta2INFt+\beta3MMRt+\beta4Mt+\varepsilon t \quad (2)$$

For the purpose of estimation, all the variables in the above equation (2) are expressed in a log-linear form.

$$LASPIt=\beta0+\beta1LEXHt+\beta2LINFt+\beta3LMMREt+\beta4LMt+\varepsilon t \quad (3)$$

where; dependent variable is all share price index (ASPI) and the independent variables are: exchange rate (EXR), Inflation (INF), Money market rate (MMR) and money supply (M).

$\beta 0$ is a constant, $\beta 1$,$\beta 2$,$\beta 3$ and $\beta 4$ are the sensitivity of each of the macroeconomic variables to stock prices and εt is a stationary error correction term.

The test for stationary of the individual series in the above econometric model (3) was undertaken by applying the Augmented Dickey Fuller (ADF) unit root test procedure using E-views version 5.0.

Testing for Unit Roots

To have a meaningful understanding of the relationship between two or more economic variables using regression technique, the time series data should satisfy some stationary properties. Hence any time series analysis should start by checking the order of integration of each variable. The Augmented Dickey Fuller (ADF) (see Gujrati, 2007) test used to examines the presence of unit roots in the data series. The general form of ADF test can be written as follows

$$\Delta Yt=a+bt+pYt-1+i=1k\nabla Yt-1+Ut \quad (4)$$

where, Yt is the individual time series, ΔYt, is the first difference of the series Yt. Here, ΔYt = Yt - Yt-1, k is the lag order, t is the linear time trend. Ut is serially uncorrelated random term with zero means and constant variance, and a - is constant.

Testing for Co-integration

Co-integration technique are used to examine the long run relationship between economic variables if they are integrated of order one (1). A long run relationship means that the variables move together over time, so that short run disturbances from the long run trend will be corrected (Manning and Andrianacos, 1993). This study adopts Johanson and Juseliues (1990) method of co-integration. This method requires that variables entering the co-integration relationship to be integrated of the same order and yields two likelihood statistics known as trace and maximum eigen value statistics which are given by:

$$\lambda tracer=-Ti=r+1n\ln \ (1-\lambda i) \quad (5)$$

$$\lambda maxr,r+1=-Tln(1-\lambda r+1) \quad (6)$$

where, T is the number of observation; i is the ith eigen value λi and r = 0, 1, 2… n-1. The trace statistic tests the null hypothesis of at most r co-integration relations against the alternative of more than r co-integrating relations. Further the optimum lag length used in the estimation is obtained on the basis of the Akaike Information Criteria (AIC).

Data Collection

The required data for this study is collected mainly from secondary sources with monthly basis from January 2001 to December 2011. The data of all share price index was obtained from Colombo Stock Exchange web site. All the other data except money supply was collected from Central Bank web site and Central Bank annual report. Money supply was obtained from international financial statistics database. The US dollar exchange rate expressed as the amount of Sri Lanka rupees per unit of US dollar (USD), the inflation rate was calculated by the changes in Colombo Consumer Price Index.

Results and Discussions

Descriptive Statistics

Table-1 presents a summary of descriptive statistics of the variables. Sample mean, maximum, minimum, standard deviation, skewness, kurtosis, Jacque-Bera statistic and p-value have been reported. The high standard deviation of LASPI with respect to the mean is an indication of high volatility in the stock market. From the p-values, the null hypothesis that LEXH, LINF, LMMR and LM are normally distributed at 5% level of significance cannot be rejected.

Table 1: Summary Statistics of variable

	LASPI	LEXH	LINF	LMMR	LM
Mean	7.530462	4.644133	2.214171	2.381691	12.30404
Maximum	8.961623	4.788099	3.343215	3.244154	12.99568
Minimum	6.000424	4.455040	-0.287682	2.012233	11.59477
Std. Dev.	0.780996	0.076484	0.629314	0.303068	0.409839
Skewness	-0.143921	-0.373144	-1.425305	0.880138	-0.128059
Kurtosis	2.433424	2.117871	6.607508	3.070352	1.988640
Jarque-Bera	2.221236	7.343046	116.2705	17.06935	5.986444
Probability	0.329355	0.025438	0.000000	0.000197	0.050126
Sum	994.0210	613.0255	292.2706	314.3832	1624.133
Sum Sq. Dev.	79.90409	0.766317	51.88076	12.03236	22.00384
Observations	132	132	132	132	132

Unit Root Test

Table 2: shows Augmented Dickey-Fuller (ADF) unit root test results to determine the order of integration and stationary of the variables. This result indicates that all the data are non-stationary at 5% levels but first differences are stationary at 1% significant level. Consistent with Figure 1: it can be concluded that all the variables are I(1).

Table 2: ADF - Unit Root Test

Variables	Level		First Differences	
	t-value	p-value	t-value	p-value
LASPI				
LEXH	-2.3748	0.3909	-11.5870	0.0000
LINF	-3.2698	0.0760	-5.7269	0.0000
LMMR	-2.3063	0.4272	-6.4652	0.0000
LM	-2.0141	0.5879	-12.7452	0.0000

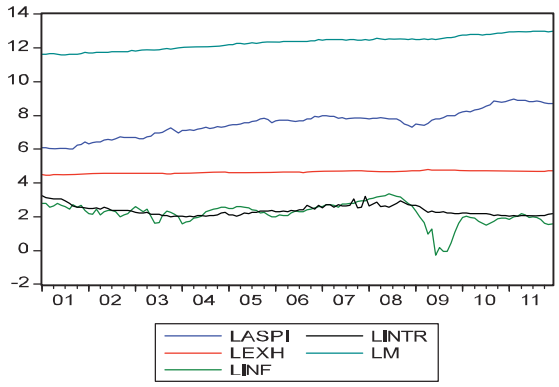


Figure 1: Logarithms of Variables

Co-integration Test and Vector Error Correction Model

The next step involves estimating the model and determining the rank, r to find the number of co-integrating relations in our model. The optimal lag length was determined by both Schwarz (SIC) and Akaike Information Criterion (AIC) using 12 maximum lags in the general VAR model. The aim is to choose the number of parameters, which minimizes the value of the information criteria. The SIC has the tendency to underestimate the lag order, while adding more lags increases the penalty for the loss of degrees of freedom. To make sure that there is no remaining autocorrelation in the VAR model, AIC is selected as the leading indicator. The

model lag length report indicates appropriate lag length of 3 for AIC.

We proceed to test for the presence of long-run relationship among the variables by using Johansen's Maximum Likelihood approach. An intercept and no trend are specified for the co-integration test. Table-3 shows the trace statistic suggests one co-integrating vectors and the maximum eigenvalue statistic indicates one co-integrating vector at the 5% significance level. This indicates co-movement between stock market index and macroeconomic variables in a long-run equilibrium path. The co-integration graph (see Figure 2) confirms that there are more than "one" mean reversion effect in the co-integration vector over the period and signifies a good error correction behavior in the co-integration system. Consequently, the estimated long-run relationship via co-integration analysis and the error correction coefficients are appropriate. The long-run co-integrating relation between the macroeconomic factors and stock prices normalized on LASPI is given by:

LASPI		**LINF**	**LMMR**	**LM**	**C**
1.000000	0.523455	-0.383817	0.690479	-2.041790	14.36956
	(0.99978)	(0.06721)	(0.13817)	(0.18714)	

The model can be re-parameterized as

$$LASPIt = -0.5234LEXHt + 0.3838LINFt - 0.6904LMMRt + 2.0417LMt - 14.3695$$

Table 3: Johansen Cointegration Test

Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.233766	78.74057	69.81889	0.0082
At most 1	0.165112	44.65830	47.85613	0.0968
At most 2	0.112829	21.55967	29.79707	0.3236
At most 3	0.044230	6.235852	15.49471	0.6676
At most 4	0.003473	0.445324	3.841466	0.5046

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

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.233766	34.08227	33.87687	0.0473
At most 1	0.165112	23.09863	27.58434	0.1693
At most 2	0.112829	15.32382	21.13162	0.2668
At most 3	0.044230	5.790528	14.26460	0.6403
At most 4	0.003473	0.445324	3.841466	0.5046

Max-eigenvalue test indicates 1 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

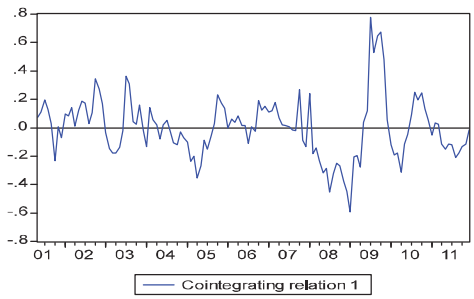


Figure 2: A Plot of Co-integration Vector normalized on LASPI

The coefficients of LINF and LM are positive sign with LASPI. And also LEXH and LMMR are negative sign with LASPI. Our expected relationship between LASPI and LINF should be positive it is exist here. Contrary to our expectation LEXH has negative relationship with LASPI. The negative relationship between LASPI and LMMR is expected, from the investor background when increasing money market rate is leads to invest any other financial institution or banks to gain high return their capital with a risk free environment.

Table 4: VECM estimation for LASPI

Variables	Coefficient	Std. Error	t-Statistic	Prob.
ECT	0.002465	0.041774	0.059012	0.953
D(LASPI(-1))	0.078839	0.103641	0.76069	0.4485
D(LASPI(-2))	-0.02587	0.100909	-0.25637	0.7981
D(LASPI(-3))	-0.05592	0.095743	-0.58403	0.5604
D(LEXH(-1))	0.789899	0.620647	1.272702	0.2058
D(LEXH(-2))	-0.17261	0.647685	-0.2665	0.7903
D(LEXH(-3))	0.516378	0.644541	0.801157	0.4248
D(LINF(-1))	0.031031	0.033299	0.931894	0.3534
D(LINF(-2))	-0.03064	0.031231	-0.98119	0.3286
D(LINF(-3))	-0.03571	0.031995	-1.11621	0.2667
D(LMMR(-1))	-0.17705	0.065982	-2.68321	0.0084
D(LMMR(-2))	-0.12195	0.069805	-1.74704	0.0834
D(LMMR(-3))	-0.11536	0.065611	-1.75827	0.0815
D(LM(-1))	1.038802	0.315169	3.296011	0.0013
D(LM(-2))	0.118518	0.321957	0.368116	0.7135
D(LM(-3))	-0.18578	0.323674	-0.57397	0.5671
C	0.005264	0.010055	0.523544	0.6016
R-squared	0.222373	Mean dependent var		0.020939
Adjusted R-squared	0.110283	S.D. dependent var		0.076837
S.E. of regression	0.072476	Akaike info criterion		-2.28799
Sum squared resid	0.583063	Schwarz criterion		-1.9092
Log likelihood	163.4313	Durbin-Watson stat		1.98353

Table 4: shows that the error correction term estimated t value of 0.0590 is less than the critical value of t and p-value is 0.953 which is greater than 0.05, R-squared and Adjusted R-squared are 0.222 and 0.1102 respectively. As much it can be concluded that the null hypothesis of 2 short run relationship for the model All share price index = f (Inflation, Exchange rate, Money market rate, Money supply), which are between the money market rate with the stock market index and money supply with stock market index. All variables in lag 1, lag 2 and lag 3 for p-values, ASPI (0.4485, 0.7981, 0.5604), exchange rate (0.2058, 0.7903, 0.4248), inflation

(0.3534, 0.3286, 0.2667), money market rate (0.0084, 0.0834, 0.0815) and money supply (0.0013, 0.7135, 0.5671) are found to be insignificant especially in lag 2 and lag 3 in explaining changes in price index of stock market because the p value is greater than the significant level of 5%.

Conclusion

This study mainly focus to investigate the relationship between stock market, inflation rate, exchange rate, money market rate and money supply in the case of Colombo Stock Exchange in Sri Lanka. To test stationary and the order of integration of all the series, the ADF was conducted and show that all the variables are integrated in the same order I(1). The Johansen test for co-integration result indicates that there is a long run equilibrium relationship between the variables. With the big sample, the optimal lag structure for each of the VAR models was selected by minimizing Akaike's Information Criteria. In the final analysis lag of 3 are used. Johansen test procedure confirmed that there is at least 1 co-integration equation at 5% significant value for the ASPI and Macroeconomic variables. The result of VEC shows that short run relationship between the stock market index, money market rate and money supply.

Overall from these findings, some recommendations are suggested. Since the results show there is long run co-integration relationship between stock markets and those variables in Sri Lanka. A word of caution, the investors who invest in the stock market might take risk in gaining benefit from the portfolio diversification because the macroeconomics linked to all share price index which lead to stock market. Therefore, stock market returns may be adversely affected by the money market rate and exchange rate, because of increasing money market rate may lead to falls the share market capital or stocks.

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