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Classification: JEL Code: G1, G14, G15

Language: English

Great Britain Journals Press

LJP Copyright ID: 146461
Print ISSN: 2633-2299
Online ISSN: 2633-2302

London Journal of Research in Management and Business

Volume 23 | Issue 5 | Compilation 1.0

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ABSTRACT

This study measures the impact of the macroeconomic variables on the All-Share Price Index (ASPI) of the Colombo stock exchange in Sri Lanka. Monthly data collected from the CSE data library and the Central Bank of Sri Lanka publications from 2008 to 2020 were employed.

The dependent variable is the All-Share Price Index (ASPI), and the independent macroeconomic variables are gross domestic production (GDP), interest rate, exchange rate, inflation rate, money supply, and reserve money.

The Augmented Dickey-Fuller test was employed to test for stationarity, and the results indicate that all the variables are integrated in the same order I (1). The co-integration analysis for the selected macroeconomic variables and ASPI were carried out to test for the existence of the long-run relationship and the Vector Error Correction Model (VECM). The Johansen co-integration test and the VECM have been performed in this study. The multivariate regression analysis was performed using the selected six independent macroeconomic variables on ASPI, and the parameters were estimated using Ordinary Least Square (OLS) method. The results indicate that the selected economic variables have an overall impact on the ASPI of Sri Lanka. Interest rate, exchange rate, and money supply negatively affected ASPI, while gross domestic production, inflation rate, and reserve money reacted positively on ASPI. The VECM shows that the GDP has had a significant impact on the growth of ASPI in the last two months. The results of the Granger Causality test indicate that the ASPI has a unidirectional causal relationship with the exchange rate, also, the exchange rate and interest rate have a significant bidirectional causality on each other at 1% and 5% levels. Furthermore, the GDP has a unidirectional causal relationship with the interest rate as well as money supply has a unidirectional causal relationship with the exchange rate, also, reserve money and money supply variables have a significant bidirectional causality with each other at a 10% significance level. Finally, the study concluded that at a 10% significance level, all the variables have a significant impact on the ASPI of Sri Lanka, and the inflation rate has a comparatively higher effect on the ASPI.

Keywords: macroeconomic variables; stock market; all share price index; sri lanka.

Author α σ ρ ¥: Department of Statistics & Computer Science, Faculty of Science, University of Peradeniya. Peradeniya, 20400, Sri Lanka.

Ѡ: Department of Economics & Statistics, Faculty of Arts, University of Peradeniya. Peradeniya, 20400, Sri Lanka.

I. INTRODUCTION

The stock market of any country acts as the mirror of its economy. The economic recession, depression, and financial crisis ultimately lead to stock market crash or development. A market where the securities such as shares, debentures, etc., issued by trade is called the 'Stock market'. Likewise, the stock market plays a significant role in the individual industry and investors who want to gain maximum return on their savings (Menike, 2010). According to Bayraktar's (2014) perspective, the stock market is not only a tool for measuring industrial growth but also a means of assessing the stability of the economy. The rising market capitalization, total turnover, and market index are signs of a growing economy. If those are failing or have fluctuations, it gives the impression of instability in such an economy.

In the past, most people saved their money by investing in commercial banks to make little interest. Nowadays, most developing nations, including Sri Lanka, favour commercial banks. Theoretically, the inflation rate of the country is highly affected by interest rates because of the economic crises in the past decade; the interest rates have been decreasing rapidly with negative fluctuations. Therefore, the number of investors saving money in savings accounts decreases, and they prefer investing money in the stock market. The stock market plays a vital role in the financial sector of every economy.

An efficient capital market drives economic growth by establishing a financial sector. Over time, the significance of the financial market in the economy has increased, and various factors can now affect the stock market's performance, as noted by Badullahewage (2018).

Today's stock markets have emerged as the primary driving force behind national and global economies.

Through stock market performance, there are more economic significances we can identify. The stock market performances are very sensitive to various macroeconomic variables and changes in the level of economic activities (Kumar & Padhi, 2012). The stock market is a primary source for many companies to raise funds for business expansions. If a company wants to increase capital for the business, it can increase shares. By utilizing the primary market of the stock exchange, businesses can issue shares and acquire the necessary funds to meet their operational needs. Considering the recorded public companies, they issue more shares to the market to gather more funds.

These primary functions of the stock exchange play the most important role in supporting the growth of industry and commerce in the country.

That is why raising the stock market is a sign of a developing industrial sector and a growing economy of a country.

Moreover, the stock market helps the redistribution of wealth through stock price increases, and dividends enhance share in the wealth of portfolio business. The price of the share is decided by the demand and supply for the share. However, it is not the only factor that affects the share price. Other factors that affect the share price are company performance, economic factors, and the country's current political situation. The uncontrollable nature of share price is evident in its susceptibility to macroeconomic variables. It provides some indication of the impact of macroeconomic variables on stock prices. The main focus of this research is to investigate the influence of macroeconomic variables on the stock market's performance in the Colombo Stock Exchange.

As well as the potential effect of the stock exchanges on aggregate demand, especially through aggregate consumption and investment.

Numerous research studies have investigated the correlation between macroeconomic factors, stock market indicators, stock return, stock prices and market capitalization (Anthony, 2008; Menike, 2010; Nijam et al., 2015).

There are a large number of investors that have invested in both domestic and international stock markets in the Sri Lankan context. The observation of the effect of macroeconomic variables on stock market performance in Sri Lanka would benefit not only portfolio managers but also economic policymakers. Also, the effect of macroeconomic variables on stock market performance is useful to evaluate how portfolio manager invests in stock heads against macroeconomic variables. Moreover, this study investigates the relationship between macroeconomic factors and the stock market performance that induce an economic policymaker to attention when decision making.

The Colombo Stock Exchange act as the most important market for capital. Well-developed capital market is essential to promote economic development (World Bank, 2020). The capital market plays an important role in the economy, and companies listed in the Colombo stock exchange are already involved in developing infrastructure. Hence Sri Lankan government has been offering various incentives to boost the stock market. The results of this study are important for local and foreign investors, policymakers, stock market regulators, stock market analysts etc.

Sri Lanka's capital market has undergone tremendous change after the reception of the liberalization policy. It has become more open to international investors, especially in the context of the post-war economy and subsequent economic revitalizations in Sri Lanka.

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). The ASPI tracks the fluctuations of stock prices for all registered companies. Meanwhile, the S&P SL 20 (Standard & Poor's Sri Lanka 20) is a market index that monitors the performance of 20 top publicly traded companies on the Colombo Stock Exchange, using market capitalization as its basis.

These index values are calculated continuously during the trading session, with the closing values published at the end of each session (Aboocacker & Irfan, 2014). Evaluating the related literature, it is evident that macroeconomic variables such as money supply, interest rate, inflation, GDP, exchange rate, oil prices, gold price, and unemployment have been taken to measure the impact on the stock market performance. Hence, this research aimed to establish a correlation between macroeconomic indicators and the stock market's overall performance.

II. LITERATURE REVIEW

In this section, we are reviewing the past literature and the theoretical background related to the impact of economic variables on the Colombo stock market performances. Most of the researchers have selected aggregate economic variables to be employed in their research models, based on their countries' economic environment. The inflation rate, exchange rate, interest rate, money supply, gross domestic production, industrial production index, reserve money, crude oil price, and economic growth were the variables that were mostly selected to study macroeconomic conditions with stock market indices.

Nelson and Schwert (1977) examined how monthly stock returns correlated with inflation from 1953 to 1974 in the United States. Their findings suggested that there was an adverse correlation between stock returns and both anticipated and unanticipated inflation.

Chen et al. (1986) studied the effect of macroeconomic variables on the stock market return. The researchers analyzed various factors, including short-term and long-term interest rates, expected and unexpected inflation, industrial production, and the spread between high and low-grade bonds. They collected data from 1953 to 1972 and conducted 12 cross-sectional regressions. The results showed that macroeconomic variables, such as industrial production and risk premium fluctuations, notably affect the stock market's performance.

Al-Khazali & Pyun (2004) researched the generalized Fisher hypothesis in nine equity markets in various Asian countries such as Australia, Hong Kong, Indonesia, Japan, South Korea, Malaysia, the Philippines, Taiwan, and Thailand. However, their findings showed that the generalized Fisher hypothesis was rejected in all of these countries. Based on their VAR model, they concluded that variations in stock returns cannot be explained by inflation and vice versa.

The study also found that expected inflation did not affect the stochastic process of nominal stock returns. In addition, they could not identify a consistent negative relationship between stock returns and inflation shocks in all the analyzed countries.

Ahmed (2007) investigated the correlation between the stock market and several macroeconomic indicators, including money supply, treasury bill rate, interest rate, GDP, and industrial production index. By applying a range of tests such as unit roots, co-integration, and vector error correction models, the monthly dataset for the period between July 1997 and June 2005 was analyzed. The results indicated that, in general, there was no long-term relationship between the stock market index and macroeconomic variables. However, the study did suggest that changes in the interest rate or T-bill growth rate may have some impact on the market return.

Coleman & Tettey (2008) conducted a study on the Ghana Stock Exchange's performance and how it was influenced by various macroeconomic factors. Their research utilized quarterly time series data spanning from 1991 to 2005, and they employed co-integration and 15 error correction models to analyze the data. According to their results, Treasury bill rates had a minimal impact on the stock exchange's performance, while market responses were delayed in cases of inflation.

In a study conducted by Menike (2010), the impact of macroeconomic variables on stock prices in the Sri Lankan stock market was examined. The study utilized monthly data covering the timeframe from September 1991 to December 2002, employing a multivariate linear regression method. Here, there were eight macroeconomic variables that were regressed against each stock. The results indicate that the higher explanatory power of macroeconomic variables is high in explaining the stock prices of most of the stocks listed on CSE. The study held that the inflation rate and exchange rate react negatively to stock prices. Moreover, the presence of a negative effect on the Treasury bill rate, implying that whenever the interest rate on Treasury securities rises, investors tend to switch out of stocks, causing a fall in stock prices.

Pal & Mittal (2011) investigated the long-run relationship between two Indian capital markets and macroeconomic factors such as interest rate, inflation, exchange rate and gross domestic savings using the quarterly data from January 1995 to December 2008. They performed the unit root test, cointegration and error correction mechanism and found that the inflation rate impacts one capital market. The results also indicated that the Gross domestic saving was insignificant in explaining both markets. Not only the above factors, but also stock market performance is influenced by natural disasters, infrastructure development, social welfare, political situation, and political stability. However, there are very few researchers who covered this area in their studies. Several research studies investigated that there is a positive relationship between stock market performance and economic growth.

Though Sri Lankan situation may be different, when stock market transactions are low, the impact on the country's economic activity may be limited. Therefore, possible practical influences done by sectors and segments of the economy have an impact on stock market changes.

Momani & Alsharari (2011) studied the impact of macroeconomic factors on the stock prices at the Amman Stock Market of Jordan, covering the periods of 1992-2010. The macroeconomic factors were namely: interest rate, national product, money supply, and industrial product index. The results showed a significant statistical impact on share prices. However, when each factor was examined with the indices, they found that the interest rate has a statistically significant impact on the prices of the shares in the Amman Financial Market. The effect was negative on behalf of the index and the sectors index. The production index is another variable, which had a significant impact where its impact was negative for the general sectors index except for the insurance sector, which had a positive impact.

Kumar & Padhi (2012) conducted a study to examine the correlation between the BSE Sensex, the Indian stock market index, and five macroeconomic variables: industrial production index, wholesale price index, money supply, treasury bills rates, and exchange rates. They utilized Johansen's co-integration and vector error correction model to analyze the data from 1994 to 2011 and investigate the long-term equilibrium relationship between the stock market index and the macroeconomic variables.

The findings indicated that the stock market index and the selected macroeconomic variables were co-integrated, suggesting a long-term equilibrium relationship between them. The results also revealed a positive correlation between stock prices and money supply, while industrial production exhibited a negative correlation with inflation. However, the study found that the exchange rate and short-term interest rate had no significant impact on determining stock prices.

Aurangzeb (2012) studied the factor affecting the performance of the stock market in three selected South Asian countries, namely, Pakistan, India and Sri Lanka using the data collected from the period 1997 to 2010. According to the findings of the regression analysis, it was observed that the performance of the stock market in South Asian nations is positively and significantly affected by foreign direct investment and exchange rates.

Conversely, the interest rate was found to have a negative and significant impact on the stock market performance in the region. The analysis also revealed that inflation has a negative impact on the stock market performance in South Asia, but the impact was insignificant.

Aboocacker & Shehu (2014) conducted a study to investigate the impact of macroeconomic factors on the stock market performance in Sri Lanka.

The study utilized monthly data collected between January 2001 and December 2011. The independent variables of this study are inflation, exchange rate, money market rate and money supply of Sri Lanka, whereas the dependent variable is all share price index. Co-integration analysis for macroeconomic factors and all share price indices of the stock market were carried out to test for the existence and Vector Error Correction Model. It was found that both long and short-run relationships exist among the stock price index and macroeconomic variables. Using the ADF unit root test, it is shown that all the variables are integrated in the same order I (1).

According to the Johansen co-integration test results, a stable and long-term relationship exists between the variables studied.

The Johansen test procedure further supported this finding by indicating the presence of at least one co-integration equation involving the ASPI and macroeconomic variables at a significance level of 5%. The results of VEC showed that short-run relationship between the stock market index, money market rate and money supply.

Badullahewage (2018) conducted a study on how macroeconomic factors affected the performance of the stock market in Sri Lanka. The study analyzed data from 1990 to 2012 and used indexes to investigate the relationship between macroeconomic variables such as inflation, gross domestic production, interest rates, and exchange rates. The findings of the study demonstrated that all of these factors have an inseparable impact on stock market performance and that the Sri Lankan stock market has gone through many ups and downs as a result of them.

It has been discovered that inflation and exchange rates have a higher impact on stock market performance out of all the factors studied.

According to the research, an increase in indicators such as interest rates, exchange rates, and GDP has been observed to result in improved performance of both the CCPI and ASPI. In contrast, to have a better performance in the stock market, the inflation rate should be kept to a bare minimum.

Jayasundara et al., (2019) researched the relationship between macroeconomic factors and stock market performance in Sri Lanka. They analyzed monthly data from 2006 to 2016 and included two dummy variables to assess the effects of the country's civil war and the global financial crisis on share prices. The Ordinary Least Square (OLS) method was used to estimate the parameters. The findings indicate that macroeconomic variables overall impact the ASPI of Sri Lanka. Interest rates, the industrial production index, and civil war had a negative impact on ASPI, while the US Dollar exchange rate and real GDP growth rate had a positive impact on the all-share price index. The global financial crisis positively affected the all-share price index in Sri Lanka, which is contradictory to the experiences of developed countries.

III. METHODOLOGY & DATA

The main objective of this study is to investigate the relationship between the All-Share Price Index (ASPI) of the Colombo Stock Exchange and six major macroeconomic variables: Gross Domestic Production (GDP), Interest Rate, Exchange Rate, Inflation Rate, Money Supply and Reserve Money of Sri Lanka using monthly time series data between 2008 and 2020. The data were obtained from the CSE data library and central bank publications. Here, the ASPI variable is considered as a proxy to measure the performance of the Colombo stock market performance, Sri Lanka. The interest rate was measured by using 90 days treasury bonds and the inflation rate was measured by using Colombo Consumer Price Index on the base of 2013(100). Sri Lankan Rupees per unit of US dollar (USD) was taken as the exchange rate, and the money supply was measured using the M2b indicator. The following linear model is proposed to establish the relationship between ASPI and selected macroeconomic factors in Sri Lanka.

$$ASPI = f(GDP,\ INTR, EXR, INFR, MS, RESM) \quad (1)$$

For the convenience of estimation, all the above variables are expressed as a log-linear model as follows

$$lnASPI_t = \beta_0 + \beta_1 lnGDP_t + \beta_2 lnINTR_t + \beta_3 lnEXR_t + \beta_4 lnINFR_t + \beta_5 lnMS_t + \beta_6 lnRESM_t + \varepsilon_t \quad (2)$$

Where;

$lnASPI_t$ represents the log of ASPI at time t;

$lnGDP_t$ represents the log of GDP at time t;

$lnINTR_t$ represents the log of Interest rate at time t;

$lnEXR_t$ represents the log of the Exchange rate at time t;

$lnINFR_t$ represents the log of the Inflation rate at time t;

$lnMS_t$ represents the log of Money supply at time t;

$lnRESM_t$ represents the log of Reserve money at time t;

t is any given time;

ε_t is the error term;

β_0 is a constant and;

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ are the sensitivity parameters of each macroeconomic variable to the performance of the Colombo stock market, Sri Lanka.

As a preliminary step for analyzing the time series data, the test for stationarity and the test for co-integration were performed. Here, the Augmented Dickey-Fuller (ADF) unit root test is used to examine the existence of unit roots in the dataset. In addition to that, this study involves the Johansen co-integration test (Johansen & Juselius, 1990) using the trace statistic and the maximum eigenvalue method. Furthermore, this study utilizes the Vector Error Correction Model (VECM) to evaluate the short-run and long-term dynamics of variables in an attempt to identify the relationship between the variables. The final model was fitted using the Johansen normalization technique and the pairwise Granger causality test was performed to check the direction of causality. All the statistical analyses were performed using EViews 12.0 statistical software.

IV. RESULTS & DISCUSSIONS

The following table shows the summary of descriptive statistics of the variables used in this study. The sample means, median, maximum, minimum, and standard deviation have been recorded.

Table 1: Descriptive Statistics of Variables

	ASPI	GDP	Interest Rate	Exchange Rate	Inflation Rate	Money Supply (M2b)	Reserve Money
Mean	5516.768	21571.790	9.935	138.066	104.378	4200779.000	657344.000
Median	6014.950	19107.960	9.450	131.350	104.750	3600429.000	624946.100
Maximum	7798.000	212302.000	19.600	193.090	138.000	9405734.000	1021589.000
Minimum	1503.000	9540.311	4.860	107.6	69.700	1398625.000	258097.000
Std. Dev	1599.069	27087.87	3.502	24.846	18.725	2249164.000	251173.600

To have a better understanding of this study, the time-series data should satisfy some properties.

This section describes such a property called stationarity or the existence of unit roots. Here, the ADF test is utilized to find the existence of unit root using EViews statistical software on both levels and their first differences of all variables.

As a preliminary step for testing co-integration among several variables used in the above model, it is necessary to test for the presence of unit root for every individual variable using the ADF test (Dickey & Fuller, 1979) based on the auxiliary regression,

$$\Delta y_t = \alpha + \delta t + \beta y_{t-1} + \sum_{i=1}^{k} \gamma \Delta y_{t-1} + u_t. \quad (3)$$

The above ADF auxiliary regression tests for the existence of a unit root in y_t at time t.

Where;

Δy_{t-1} = The lagged first differences,

u_t = The serial correlation errors and,

α , δ , β and γ are the parameters to be estimated.

The null hypothesis for a unit root in variable y_t is $H_0: \beta = 0$ and the alternative hypothesis is $H_0: \beta < 0$. The following table describes the results of the ADF unit root test.

Table 2: ADF Unit root tests for stationarity with constant only

Variables	Levels	First Difference	5% Critical Value	1% Critical Value
Log ASPI	-2.011	-12.229	-2.880	-3.473
Log GDP	-1.040	-7.912	-2.882	-3.476
Log Interest Rate	-1.906	-8.042	-2.880	-3.473
Log Exchange Rate	-0.052	-8.261	-2.880	-3.473
Log Inflation Rate	-1.228	-7.737	-2.880	-3.474
Log Money Supply (M2b)	-0.094	-11.140	-2.880	-3.473
Log Reserve Money	-1.890	-12.695	-2.880	-3.473

If the test statistic values of the *ADF* test are larger than the critical value, then the null hypothesis is not rejected. Therefore, in such cases, we conclude that the variable under consideration is not stationary. That is, it has a unit root. This procedure should be applied once again after having transformed the series under consideration in the first differencing. If the null hypothesis of non-stationarity is rejected, it is possible to conclude that the series is integrated of order 1. Furthermore, for the *ADF* tests to be effective, it is important to choose the relevant optimal lag order such that not to reduce the power of the test. The lag order was chosen using AIC values and EViews statistical software identifies the default value of $trunc\left((length(x)-1)^{\frac{1}{3}}\right)$ as the lag order for the *ADF* test, where x denotes the variable of interest.

The above table indicates that the critical values for the levels of all variables are not significant at the 5% and 1% significance levels. Therefore, it implies that all the variables have a unit root in their level for the ADF test. However, the ADF test results for the first differences of the variables show that the critical values for all the variables are significant at the 5% and 1% significance levels. Therefore, based on these results, we reject the null hypothesis that the presence of unit root at all first differences of the variables. As a result of this test, it can be considered that the variables are integrated of order 1, I (1). Since the series are integrated of the same order I (1), then there exists a risk of co-integration.

After showing that the variables are integrated of order I, I (1), it is necessary to determine whether there is at least one linear combination of these variables. This can be done by using the co-integration method. Along with a non-stationary series, the co-integration method has been used to investigate whether a long-run relationship exists. However, to apply the co-integration test, it is necessary to have the variables under consideration integrated in the same order. In the previous section, it is clear that the variables under consideration are integrated in the same order I (1). As an initial step for applying the co-integration tests, first, specify the relevant optimal lag order of the Vector Auto-regressive (VAR) model. By the Akaike Information Criteria using 2 maximum lags, the general VAR model indicates that the optimal lag length of 1. Based on the above unit-root tests, the Johansen co-integration test can be applied. The following vector autoregressive framework of order p can be used to express the Johansen co-integration method.

$$X_t = A_0 + \sum_{j=1}^{p} B_j X_{t-j} + e_t \qquad (4)$$

Where;

X_t = An $n\times1$ vector of non-stationary I (1) variables,

A_0 = An $n\times1$ vector of constants,

p = The maximum lag length,

B_j = An $n\times n$ matrix of coefficients and,

e_t = An $n\times1$ vector of white noise terms.

To use the Johansen co-integration method, the above equation (4) should be turned into a vector error correction model (VECM) and it can be written as follows.

$$\Delta X_t = A_0 + \sum_{j=1}^{p-1} \Gamma_j \Delta X_{t-j} + \Pi X_{t-p} + e_t \qquad (5)$$

Where;

Δ = The first difference operator,

$\Gamma_j = -\sum_{i=j+1}^{p} B_j$,

$\Pi = -I + \sum_{i=j+1}^{p} B_j$ and,

I = An $n\times n$ identity matrix.

The co-integration test between the X values is calculated by finding the rank of the Π matrix using its eigenvalues. In this test, the null hypothesis can be expressed as H_0: $\Pi = \alpha\beta'$, where α and β represent loading matrices of eigenvectors with dimensions $n\times r$. The matrix β is responsible for providing co-integration vectors, while α represents the adjustment parameters. The number of co-integrating relations can be tested by using the following trace statistic and the maximum eigenvalue test statistic given below.

Trace statistic:

$$\lambda_{trace}(r) = -T \sum_{i=j+1}^{p} ln(1-\hat{\lambda}_j) \qquad (6)$$

Maximum eigenvalue statistic:

$$\lambda_{max}(r, r+1) = -T ln(1 - \hat{\lambda}_{r+1}) \quad (7)$$

Where,

r = The number of co-integrating vectors under the null hypothesis,

T = The number of observations that are usable and,

$\hat{\lambda}_j$ = The value estimated for the j^{th} ordered characteristic root or eigenvalue from the Π matrix

A significant co-integrating vector can be identified utilizing significant non-zero eigenvalues. The null hypothesis of the trace statistic suggests that the number of co-integrating vectors is less than or equal to r, whereas the alternative hypothesis suggests that there are more than r co-integrating relations. The maximum eigenvalue test indicates the null hypothesis of the number of co-integrating vectors is less than or equal to r, versus the alternative hypothesis of (r+1) co-integrating vectors. Tables 3 and 4 present the results obtained from the Johansen method of both trace test and maximum eigenvalue test using EViews statistical software, starting with the null hypothesis of no co-integration (r=0) among all variables.

Table 3: Johansen Co-Integration Test (Trace)

Eigenvalue	Trace Statistic	5% Critical Value	P - Value	No. of CE (s)
0.341	161.283	125.615	0.000	None
0.223	97.399	95.754	0.038	At most 1
0.158	58.833	69.819	0.273	At most 2
0.104	32.502	47.856	0.584	At most 3
0.060	15.687	29.797	0.734	At most 4
0.040	6.255	15.495	0.665	At most 5

SERIES: LASPI, LGDP, LINTR, LEXR, LINFR, LMS, LRESM

Test Assumption: Linear Deterministic Trend in the Data

The data reported in above Table 3 shows that the null hypothesis of no co-integrating vector or at most one co-integrating vector can be rejected at the 5% significance level, thereby suggesting the presence of two co-integrating equations.

Therefore, according to the results of Table 3 above, at a 5% significance level, the trace statistic suggests at most two co-integrating vectors (r=2) are significant.

Table 4: Johansen Co-Integration Test (Max-Eigen)

Eigenvalue	Max-Eigen Statistic	5% Critical Value	P - Value	No. of CE (s)
0.341	63.884	46.231	0.000	None
0.223	38.566	40.078	0.073	At most 1
0.158	26.331	33.877	0.301	At most 2
0.104	16.815	27.584	0.596	At most 3
0.060	9.432	21.132	0.796	At most 4
0.040	6.252	14.265	0.581	At most 5

SERIES: LASPI, LGDP, LINTR, LEXR, LINFR, LMS, LRESM

Test Assumption: Linear Deterministic Trend in the Data

As the results of Table 4, the null hypothesis of no co-integrating vector can be rejected at the 5% significance level and indicates the presence of one co-integrating equation. Therefore, the maximum eigenvalue statistic suggests that at most one co-integrating vector (r=1) is significant.

Therefore, by using both trace and maximum eigenvalue tests, it can be concluded that there are two co-integrating relations among the variables and it is another evidence to say that the variables are co-integrated. That is, there exists a linear combination of the I (1) variables and a stable long-run relationship.

By taking one co-integrating vector and two co-integrating vectors, the short-run and long-run interaction of the selected economic variables, the VECM has been estimated based on the Johansen co-integration method. The results demonstrate that the ASPI and the economic variables have a long-run equilibrium relationship. The estimated co-integrating coefficients for the first and second normalized eigenvectors are as follows.

Table 5: Normalized co-integrating coefficients (Standard error parenthesis)

Equation Type	Log ASPI	Log GDP	Log Interest Rate	Log Exchange Rate	Log Inflation Rate	Log Money Supply	Log Reserve Money	Constant
One co-integrating equation	1.000	9.526 (1.145)	1.216 (1.234)	-14.010 (9.679)	-74.860 (19.234)	28.140 (9.585)	-7.005 (3.934)	-9.000
Two co-integrating equations	1.000	0.000	0.222 (0.103)	2.107 (0.804)	-7.827 (1.492)	2.002 (0.772)	-0.711 (0.325)	
	0.000	1.000	0.104 (0.128)	-1.692 (1.000)	-7.037 (1.857)	2.744 (0.961)	-0.661 (0.404)	

The above co-integrating long-run model can be re-parameterized as follows:

$$LASPI = -9.526LGDP - 1.216LINTR + 14.010LEXCHR + 74.860LINFR - 28.140LMS + 7.005LRESM + 9.000 \quad (8)$$

In the long term, there is a significant negative statistical relationship between all share price indexes and gross domestic production, interest rates, and money supply variables. In other words, gross domestic production, interest rates, and money supply variables allow long-term all share price index values to be reduced. Moreover, there is a positive relationship between the share price index and exchange rates, inflation rates, and reserve money variables. That is exchange rates, inflation rates, and money supply variables support increasing the long-term share price index values.

The estimated coefficients, standard errors, t statistics and p values of the log-linear model (2) and its R-Squared, adjusted R-Squared values are summarized in Table 6 below.

Table 6: Regression Outputs

Dependent Variable: LASPI Method: Least Squares				
Variable	Coefficient	Std. Error	t-statistic	Prob.
Intercept	1.926	0.323	5.958	0.000***
Log GDP	0.084	0.048	1.752	0.082*
Log Interest Rate	-0.320	0.062	-5.202	0.000***
Log Exchange Rate	-2.644	0.458	-5.767	0.000***
Log Inflation Rate	3.866	0.816	4.741	0.000***
Log Money Supply	-0.682	0.410	-1.664	0.098*
Log Reserve Money	0.705	0.189	3.734	0.000***
R-Squared	0.7881			
Adjusted R-Squared	0.7796			

Note: *Denotes significance at 10% level. **denotes significance at the 5% level and ***denotes significance at the 1% level.

The above log-linear model can be re-parameterized as follows:

$$LASPI = 1.926 + 0.084LGDP - 0.320LINTR - 2.644LEXCHR + 3.866LINFR - 0.682LMS + 0.705LRESM \quad (9)$$

The significance of each variable is tested by using the t-test. The null hypothesis of this test stated that there is no significant impact from the independent economic variable on ASPI, whereas the alternative hypothesis stated that there is a significant relationship between the independent economic variable on ASPI. According to the regression outputs in Table 6, using p-values, it can be considered as all the macroeconomic variables show significant effects on the ASPI of Sri Lanka at a 10% level. Additionally, using the R-squared value, it is evidence to say that 78.81% of the total variation is explained by the above log-linear model (9) and the adjusted R-squared in the above table suggests that the fitted model is approximately 77.96% reliable.

If it is given that a co-integrating relationship is present among the selected variables in level form, an error correction model can be estimated.

An error correction model is used to identify the short-run dynamic response of ASPI and other economic variables. The VECM is a restricted VAR developed to be utilized with known co-integrated nonstationary series. The VEC has co-integration relations built into the specification so that it restricts the long-run behaviour of the economic variables to converge to their co-integrating relationships while allowing for short-run adjustment dynamics. VECM relates changes in ASPI growth to changes in the other lagged variables and the disturbance term of lagged periods. Table 7 shows the results of the VECM short-run dynamic relationship and the short-run relationship coefficients using EViews statistical software.

Table 7: Vector Error Correction Estimates for LASPI

Dependent Variable Δ(LASPI) 153 observations are used after adjustments				
Variables	Coefficient	Std. Error	t-Statistic	P-value
ECT	-0.0065	0.0055	-1.1858	0.2375
Δ (LASPI(-1))	-0.4796	0.0843	-5.6873	0.0000***
Δ (LASPI(-2))	-0.1896	0.0848	-2.2363	0.0268**
Δ (LGDP(-1))	0.0747	0.0555	1.3453	0.1805
Δ (LGDP(-2))	0.0937	0.0544	1.7240	0.0867*
Δ (LINTR(-1))	0.1644	0.2556	0.6433	0.1024
Δ (LINTR(-2))	-0.2504	0.2485	-1.0076	0.3152
Δ (LEXR(-1))	-1.6721	1.2191	-1.3716	0.1722
Δ (LEXT(-2))	-0.3305	1.2234	0.2701	0.7874
Δ (LINFR(-1))	0.2442	1.1342	0.2153	0.8298
Δ (LINFR(-2))	-0.5311	1.1088	-0.4790	0.6326
Δ (LMS(-1))	1.3582	1.8022	0.7536	0.4522
Δ (LMS(-2))	2.4823	1.7897	1.3870	0.1675
Δ (LRESM(-1))	-0.0833	0.4108	-0.2029	0.8395
Δ (LRESM(-2))	-0.0873	0.4134	-0.2111	0.8331
Constant	-0.0134	0.0139	-0.9667	0.3352

Note: *Denotes significance at 10% level. **denotes significance at the 5% level and ***denotes significance at the 1% level.

The VECM short-run results are presented in Table 7. It is evident that Δ (LASPI (-1)) and Δ (LASPI (-2)) are statistically significant at a 5% level with priori expected signs. The coefficient of Error Correction Term (ECT) is correct in sign and insignificant. However, it is fairly small, that is, 0.0065. This implies, nearly 0.65% of the disequilibria in ASPI of the previous month's affect back to the long-run equilibrium in the current month. The interest rates, US dollar exchange rates, inflation rates and reserve money variables had a negative impact on the growth of the all-share price index of Sri Lanka for the last two months and those effects are not statistically significant at a 1% level. The gross domestic product has a positive and significant (at 10% level) impact. In contrast, the other macroeconomic variables have a positive and insignificant (at 1% level) impact on the growth of all share price indexes of Sri Lanka. Therefore, when the GDP of the last two months are increasing, it will cause the growth in ASPI by 0.0937 units. According to the records of the past two months, the growth in ASPI has a negative and significant impact on the current growth in ASPI. Therefore, according to the above results, GDP is a significant determinant of the growth of ASPI.

The VECM can identify the short-run dynamics and the long-run equilibrium relations between the time series variables. Therefore, it can distinguish between the short-run and long-run Granger causality. In other words, the Granger causality test is used to find the joint significance of the coefficients of the differenced explanatory variables. To further understand this study, the Granger casualty test has been employed to check the direction of causality and the results are presented in Table 8. The F-statistic and probability values are estimated using 153 observations and 2 months lags under the null hypothesis of no causality.

Table 8: Pairwise Granger Causality Test

Null Hypothesis	F - statistic	Prob.
Δ(LGDP) does not Granger Cause Δ(LASPI) Δ(LASPI) does not Granger Cause Δ(LGDP)	1.105 0.051	0.334 0.951
Δ(LINTR) does not Granger Cause Δ(LASPI) Δ(LASPI) does not Granger Cause Δ(LINTR)	1.465 0.288	0.234 0.750
Δ(LEXR) does not Granger Cause Δ(LASPI) Δ(LASPI) does not Granger Cause Δ(LEXR)	0.910 8.070	0.405 0.001***
Δ(LINFR) does not Granger Cause Δ(LASPI) Δ(LASPI) does not Granger Cause Δ(LINFR)	0.068 1.798	0.934 0.169
Δ(LMS) does not Granger Cause Δ(LASPI) Δ(LASPI) does not Granger Cause Δ(LMS)	0.747 0.848	0.476 0.430
Δ(LRESM) does not Granger Cause Δ(LASPI) Δ(LASPI) does not Granger Cause Δ(LRESM)	0.003 0.630	0.998 0.534
Δ(LINTR) does not Granger Cause Δ(LGDP) Δ(LGDP) does not Granger Cause Δ(LINTR)	0.106 2.960	0.900 0.055*
Δ(LEXR) does not Granger Cause Δ(LGDP) Δ(LGDP) does not Granger Cause Δ(LEXR)	0.206 0.307	0.814 0.736
Δ(LINFR) does not Granger Cause Δ(LGDP) Δ(LGDP) does not Granger Cause Δ(LINFR)	0.135 0.323	0.874 0.725
Δ(LMS) does not Granger Cause Δ(LGDP) Δ(LGDP) does not Granger Cause Δ(LMS)	1.396 0.815	0.251 0.445
Δ(LRESM) does not Granger Cause Δ(LGDP) Δ(LGDP) does not Granger Cause Δ(LRESM)	0.671 0.090	0.513 0.914
Δ(LEXR) does not Granger Cause Δ(LINTR) Δ(LINTR) does not Granger Cause Δ(LEXR)	5.021 5.292	0.008*** 0.006***
Δ(LINFR) does not Granger Cause Δ(LINTR) Δ(LINTR) does not Granger Cause Δ(LINFR)	0.300 0.394	0.741 0.675
Δ(LMS) does not Granger Cause Δ(LINTR) Δ(LINTR) does not Granger Cause Δ(LMS)	1.563 0.242	0.213 0.785
Δ(LRESM) does not Granger Cause Δ(LINTR) Δ(LINTR) does not Granger Cause Δ(LRESM)	0.109 1.030	0.897 0.340
Δ(LINFR) does not Granger Cause Δ(LEXR) Δ(LEXR) does not Granger Cause Δ(LINFR)	0.584 0.498	0.559 0.609
Δ(LMS) does not Granger Cause Δ(LEXR) Δ(LEXR) does not Granger Cause Δ(LMS)	2.363 1.256	0.098* 0.288

Δ(LRESM) does not Granger Cause Δ(LEXR) Δ(LEXR) does not Granger Cause Δ(LRESM)	0.741 0.819	0.478 0.443
Δ(LMS) does not Granger Cause Δ(LINFR) Δ(LINFR) does not Granger Cause Δ(LMS)	1.262 1.325	0.286 0.269
Δ(LRESM) does not Granger Cause Δ(LINFR) Δ(LINFR) does not Granger Cause Δ(LRESM)	2.742 2.395	0.068* 0.095*
Δ(LRESM) does not Granger Cause Δ(LMS) Δ(LMS) does not Granger Cause Δ(LRESM)	0.484 1.956	0.617 0.145

Note: *Denotes significance at 10% level. **denotes significance at the 5% level and ***denotes significance at the 1% level.

The results of the Granger Causality test indicate that the ASPI and exchange rate have a significant unidirectional causality, also the exchange rate and interest rate have a significant bidirectional causality on each other at 1% and 5% levels.

Furthermore, the GDP and interest rate have a unidirectional causality and money supply and exchange rate have a unidirectional causality. Finally, reserve money and money supply variables have a significant bidirectional causality on each other at 10% level. The results of this test also indicate that all the other pairs of variables do not have a significant causal relationship with each other at 1% and 5% levels.

V. CONCLUSIONS AND POLICY RECOMMENDATION

The main objective of this study is to investigate the impact of selected economic variables on the Colombo Stock Market Performances for 2008–2020. The ADF test was conducted to test the stationarity and the order of integration of all the series. It showed that all the variables are integrated in the same order I (1). The Johansen co-integration test results indicate a long-run relationship between the variables. The optimal lag length for each VAR model was selected by minimizing the Akaike Information criteria, and the final analysis used a lag length of 2. The estimated regression model shows a positive relationship between ASPI with GDP, Inflation rate and Reserve money. Simultaneously, there is a negative relationship between the Interest rate, Exchange rate and Money Supply. The VECM model shows that there is a long-run relationship between the ASPI and all other variables during the first two-month lags and especially the gross domestic product has a positive and significant impact on the growth of ASPI for the last two-month lags. The results of Granger's causality test indicate a significant effect of ASPI on the exchange rate, and it is not affected by the other variables. Finally, the overall findings suggest that all the selected economic variables have been significantly affected by the ASPI. Those variables are the most powerful estimators for estimating the Stock market performances of Sri Lanka.

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