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Economic Factors and Stock Market Performance: Sri Lankan Context

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Abstract: This research aims to understand the effect of macroeconomic factors on the performance of the share market, which would attract the attention of economic policymakers in terms of enhancing investments within Sri Lanka. The study followed a positivism research philosophy and applied a deductive research approach. Thereby, the quantitative data was used to reach conclusions. The study derived two macroeconomic factors based on the key macroeconomic variables by using Principal Component Factoring: Economic Growth Factor and Time Value of Money Factor for the analysis. Based on the monthly data collected for 213 months from January 2002 to September 2019, the study developed GARCH (1,1) model to understand the time-series impact of the macroeconomic factors on the All-Share Price Index. The results of the GARCH (1,1) model revealed that the All-Share Price Index of the previous month and the time value of money factor are more deterministic when forecasting the share market performance in the forthcoming month. However, the economic growth factor showed an insignificant impact on the performance of the Colombo Stock Exchange. In conclusion, better share market performance of the previous month and time value of money factor together are significantly impacting to motivate investors in the Sri Lankan stock exchange than other macroeconomic variables (ceteris paribus).

Keywords: Economic Growth Factor, GARCH (1,1), Macroeconomic Factors, Share Market Performance, Time Value of Money Factor

1. Introduction

Different internal and external factors may influence determining the price of an investment asset [1, 5, 18]. Thus, the behavior of trading prices is determining the performance of a stock exchange. Thereby, this study evaluates the phenomena in Colombo Stock Exchange (CSE) while focusing on the macroeconomic environment, aiming to identify the impact of underlying macroeconomic factors on the performance of the Sri Lankan stock exchange.

Arbitrage Pricing Theory (APT) states that the pricing of an underlying asset should be done based on its exposure to economic variables [1, 2]. So, when emerging economies boom, it attracts global attention to their financial instruments resulting in a "bull market" condition. However,

in APT, neither the risk-deterministic factors nor the type of risk determinants individually would decide the prices of underlying assets. Therefore, the theoretical gap between the Asset Pricing Problem and current stock exchange phenomena motivates us to evaluate the performance of stock markets in different periods and its influential factors.

While affirming the conclusion of EMH, Maysami, Howe, and Hamzah [3] emphasized that it is possible to forecast the time series of stock prices using the key macroeconomic variables. Meanwhile, a study suggests that the performance of stocks is determined by both firm-specific and macro factors [4]. Fama [5] states that an aggressive price adjustment of stocks creates frequent 'new information' within an effective capital market.

Stock markets in different nations have provided investor-friendly opportunities to foreign investors by maintaining a sustainable political and legal environment [6]. Therefore,

achieving promising growth within economies through the share market performance has become a prominent factor [7-9].

In terms of performance, the Asian finance market attracted the world's attention in the last few decades while providing attractive investment opportunities. The Asian finance market is a growing market that performed effectively after the liberalization of regional countries [6]. Accordingly, a well-performing and liquid stock market may minimize the effect of unsystematic risk while improving the marginal productivity of Capital [10].

When observing the All-Share Price Index (ASPI) of the Colombo Stock Exchange (CSE) from January 2002 to May 2019, ASPI shows considerable growth from 2002 to 2009.

However, ASPI shows an exponential increment after 2009 [11]. The peace process, stable political environment, foreign aid, low-interest rates, improved economic fundamentals, and increased profitability in listed companies during this period would have caused positively on better performance of the stock exchange in Sri Lanka [12].

However, the share market indicators revealed a considerable decline throughout 2010 – 2012 [11]. Even though there had been considerable foreign participation within the share market, in 2012 there is a significant drop in foreign transactions. Further, during 2011 and 2012 the market capitalization remains constant since there was no significant market participation [4].

Table 1. Primary and Secondary Market Dealings of Sri Lanka in the Last Decade.

	Rate of Annual Growth (%)							
	2011	2012	2013	2014	2015	2016	2017	2018
Primary Market Dealing	17.2	45.8	-12.6	-12	-4.4	-20.4	13.1	-10.2
Secondary Market Dealing	11.5	9	57.1	-1.9	27.8	42.9	-22.3	-10.5

The growth rates of primary-market dealings and secondary-market dealings published by the CBSL (Table 1) further convince the volatility of the performance in the stock exchange. Further, CBSL confirms that the primary market dealings have grown until 2012, and later it has decreased continuously. Thereby, the companies have reduced the introduction of new investment instruments to the stock market. The dealings within the secondary market also decreased after 2013.

Such diminishing performance of the stock exchange could create shocks in the share prices, which cause the demotivation of the investors. Meanwhile, the low liquidity condition could challenge the financial health of the companies listed on CSE. Further, these diminishing trends could block the liquidity of frequent investors, leading to high capital losses.

The instability of the local political environment also impacted to create changes in the macroeconomic policies frequently. However, the economy is focusing on changing its policies to enhance productivity in the recent past. Corresponding to these changes, the ASPI signals a significant effect of APT [1] between 2009 to 2012.

The macroeconomic variables are multicollinear in nature. Thus, having correlated predictors in a model could cause a reduction in the precision of the estimated coefficients weakening the statistical power of the model. It could increase the standard error of the model. Also, the multicollinear impact could cause the conversion of significant variables into insignificant [13].

Thereby, while addressing these issues within the developed models, the current study focused on a broader level of macroeconomic variables. The study used exploratory factor analysis to derive factors from those variables which will combine the highly correlated macroeconomic variables into a common factor, developing a new predictor variable. Thereby, this study focuses on those derived macroeconomic factors than the traditional macroeconomic variables.

Accordingly, the study occupies the exploratory factor analysis technique to reduce the number of macroeconomic variables into fewer macroeconomic factors by extracting maximum common variance from all variables and putting them into a common score. Even though the rationale use of factor analysis has been debated widely, this method has been considered in many social fields [14-16]. Further, the exploratory factor analysis procedure provides more accurate results when each common factor is represented by multiple measured variables [15].

The findings of this study will help the policymakers to understand the impact of current and upcoming policies on the share market performance. Further, the research findings may help investors to make effective investment decisions with better timing decisions. Thirdly, it is possible to minimize the effect of the market shocks that occur due to the fluctuations in the financial market and the economy by making awareness among the public to take protective measures [17].

There can be different firm-specific and external factors impacting to determine the performance of a share market [4]. However, the current study only considered macroeconomic factors. Thereby, the study used the "Ceturis Paribus" assumption to conceptualize this research. So, it was assumed that all the other factors impacting to determine the performance of the share market are remaining constant. Also, the fluctuations of the considered variables are not always determined based on the market forces. The variables, such as exchange rate and interest rate, vary due to political and economic policy decisions. Such variations cause to weaken the findings of the study with the reality of the economic environment.

2. Literature Review

2.1. Theoretical Review

Financial theories consider the Capital Asset Pricing Model (CAPM) [18] as a tool to estimate the discounting

rates to identify the fair value of an investment asset. This is a common model used in corporate finance to define the discount rate of a project. While analyzing the risk function, CAPM values the investment without considering the investor preference and the expected return of any underlying asset [19]. But it values the expected return of a risky asset by considering both the risk-free rate of return (Rf) and the unsystematic risk proportion, or the risk premium (Rp) [20]. It is possible to derive the equilibrium in expected returns based on the information or information sequence addressed as "fair game." Thereby, the expected return of an underlying asset can make a more detailed statement about the economic environment [5, 21-23].

2.2. Empirical Review

An efficient financial system is the key coordinator of the financial intermediation of an economy. Also, the development of financial markets has motivated economic growth by improving marginal productivity while increasing the efficiency of capital accumulation [24]. 85% of the sampled countries of the study have achieved economic growth through successful financial intermediation [25]. It highlights that promoting financial intermediation is a predominant factor for growth in any country. Studies stated that the stock exchange is a significant element of a financial sector that motivates capital inflows; thus, affecting economic growth [26, 27, 21]. Prior researchers have used market capitalization as a performance indicator when measuring stock exchange performance in different economic contexts [28, 29].

A study with the period break for Pakistan's economy to analyze stock exchange performance before and after the nuclear test in 1998 revealed bidirectional long-run causation among share prices and interest and exchange rate, consumer prices, and GDP [30]. Further, the previous behavior of earnings per share and stock prices, company size, GDP growth, financial depth, and interest rate have a significant association with the prices of shares in the Pakistan economy [31]. Thus, economic growth is a critical determinant in determining both the short and long-run performance of the share market in Ghana [28].

Tripathi and Seth [29] derived three principal factors to evaluate their impact on stock market performance in India. Moreover, India based study conducted a factor analysis using twelve (12) macroeconomic variables and revealed that industrial performance factor significantly influences the stock market more than policy rates [32] while affirming the importance of macroeconomic stability to optimize the performance of the share market. The factor analysis technique has been used in many studies to identify the significant common factors that are impacting to determine the share market performance in different economic contexts [33-35].

Based on APT's conclusion, a study focused on the behavior of the investment assets in parallel to the variations of expected and unexpected inflation rates in the United States revealed that the common stock returns are negatively related to the expected inflation and unexpected inflation [36]. This relationship was further confirmed by studies in

different economic contexts [37, 23, 6]. However, an argument was developed as such a negative relationship could depend on the adaptive expectation model and when the model is reversed then changes in rates could cause changes in stock prices [38].

It was confirmed a cointegrating relationship between exchange rate, inflation rate, money supply, industrial production, long-term government bond rate, call money rate, and stock prices and the stock market [3, 39]. Yet, the inflation, money, and stock exchange performance do not maintain any significant association with the share market in the SAARC [40]. Meanwhile, a positive association between macroeconomic factors and legal-environmental factors, and investment decisions were identified among listed Polish companies [41].

Gold is an investment commodity used by investors expecting a higher return compared to banks [42]. Thus, oil prices are considered a significant component of any country which is a key deterministic factor in the consumption and production of a given economy. The gold and oil prices show a significant impact on the performance of the stock market in Pakistan [43]. An Iran-based study confirmed that the world oil price with one lag has a significant positive effect while the gold price has a significant negative effect on the stock returns of banks [44]. However, the stock market index converges to its long-run equilibrium with the contribution of gold and oil market prices and their volatilities [45].

Within the Sri Lankan context, a significant positive association between gross domestic production, interest rates, foreign exchange rate, and inflation rate, and CSE's performance was identified over the period from 1980 to 2012 [46]. However, from January 1986 to December 2014, there are significant long-run and short-run effects in determining the stock market indices [47]. Parallelly, a causal relationship between ASPI and different economic factors such as interest rate, the United States share price index, and GDP was revealed from January 1985 to December 2004 [48].

A positive relationship between money supply and one-lagged inflation rate and stock returns was identified during the period from September 1991 to December 2002 in Sri Lanka [49]. In contrast, the exchange rate and risk-free interest rate are negatively related to the stock returns as per this study. Albeit a positive relationship between interest rate, exchange rate, GDP, and ASPI was found, while the inflation rate shows a negative relationship with ASPI for the period from 1990 to 2012 [22]. Thus, maintaining a low inflation rate is a positive trait to achieve a better CSE performance [22]. As per Perera [50], although the exchange rate, inflation rate, and interest rate are insignificant in determining CSE's performance, the money supply is positively significant in determining ASPI.

When analyzing the behavior of macroeconomic variables, the growth of Gross Domestic Production in Sri Lanka shows more heteroscedastic volatility from 1970 to 2016 [51]. Simultaneously, the inflation rate and interest rate also show more heteroscedastic behavior from 1978 to 2017 [51]. Thus, the rupee depreciation has been sped up within the last decade [51]. Meanwhile, the existence of volatility clustering

is confirmed in the stock market returns during the war period and post-war period in Sri Lanka [52]. Thus, the attraction of investors to the economy has been highlighted as a critical element in fulfilling the investment and savings gap within Sri Lanka [51].

Though there are studies conducted to analyze the impact of macroeconomic variables on the stock exchange performance within the Sri Lankan economy, the current study intends to identify the impact of common macroeconomic factors on share market performance while focusing on the multicollinearity effect of the selected macroeconomic variables.

Thus, this study occupies the factor analysis technique to conclude. The study focused on exploratory factor analysis to measure the underlying factors that affect the variables in the data structure without setting any predefined structure for the outcome. Since the derived factors are explained with the factor loadings the study focused on deriving a dynamic factor model [53]. Thus, the study uses principal component factoring to extract the factors, as it is assumed that the communalities for all the variables are equal to one and consequently no prior estimates are required for communalities [54, 55].

3. Research Methodology

The study follows the positivism philosophy, which assesses the theories. Based on the deductive approach, the study used the quantitative mono method to analyze the data. The study considered high frequent time-series data for 213 months within the sample period from January 2002, the year which the peace process was initiated [56] to September 2019 which consists of both economic booms and recessions. Due to the market shocks incurred due to the Covid 19 pandemic in the share market from 2020 to 2021, the secondary data was collected only up to the third quarter of 2019 through the monthly and quarterly reports published by the Central Bank of Sri Lanka.

Considering the Inflation Rate (CCPI), Gold Prices (GP), Crude Oil Prices (OP), Money Supply (MS), Treasury Bill Rate (TB), Foreign Exchange Rate (FER), Gross Domestic Production (GDP) the study attempted to derive macro-economic factors to compare the impact of such macro factors on Share Market Performance (ASPI). Thereby, the duly developed hypotheses are,

H1a: There is a significant impact from macroeconomic factor 1 on the performance of the share market.

H1b: There is a significant impact from the macroeconomic factor 2 on the performance of the share market.

Besides, the direction of the macroeconomic factors was not explained since those are unique from the macroeconomic variables considered in the studies so far. The study used the All-Share Price Index [57] which is the measure of the movements of the overall market based on market capitalization to assess the share market performance.

The existence of a correlation between the macroeconomic variables creates difficulty in determining the number of factors in advance. So, the factors were derived based on the exploratory factor analysis method. Accordingly, the study used the following assumptions related to the data [54].

i. Means of the original variables, unique and common factors are zeros.
ii. The variance of the original variables is unique, and common factors are one.
iii. The unique factors are not correlated among themselves or with common factors.

The factors were extracted using Principal Component Factoring (PCF) under the exploratory factor analysis method. The extracted factors have been rotated using orthogonal rotation to identify the most suitable combination. The study used Varimax, Quartimax, and Equamax rotation methods to rotate variables and compared the results before selecting the most appropriate rotation method. Based on the communalities of the most appropriate rotation method, the macroeconomic variables were selected for each factor and obtained factor coefficients (β_i) to derive the factors. A linear function for the common factor has been derived using the factor score coefficients of the observed variables.

Accordingly, $\widehat{F_i}$ be the estimated factor score for the jth factor then,

$$\widehat{F_j} = \widehat{\beta_1}\, x_1 + \widehat{\beta_2}\, x_2 + \cdots + \widehat{\beta_j}\, x_i \; (i = 1,2 \ldots m) \quad (1)$$

Thus, β_i's are the coefficients of linear combinations to predict the selected factors' values, known as factor coefficients (loading of each macroeconomic variable in determining the factor). X_i is the predictor of the factor F_j at i^{th} time (macroeconomic variable selected for each factor as per the results of the rotation).

Derived factors have been analyzed by using the GARCH (1,1) model to identify the persistence of volatility shocks and the relationship between the considered factors. Further, with the 5% of significance level, the study assessed the hypothesis by using the outcome of the GARCH (1,1) model.

Table 2. Operationalization of Variables.

Variable	Measurement	Symbol Used
Share market performance	Monthly All Share Price Index	ASPI
Inflation Rate	Monthly Colombo Consumer Price Index	CCPI
Gold Prices	Gold Prices per Troy oz. (Last day of each month)	GP
Crude Oil Prices	Price in Sri Lankan Rupee per Crude Oil Barrel (Last day of each month)	OP
Money Supply	Monthly Broad Money Supply (M4)	MS
Treasury Bill Rate	Monthly Treasury Bill Interest Rate	TR
Foreign Exchange Rate	1US Dollar to Sri Lankan Rupee exchange rate (Last day of each month)	FER
Gross Domestic Production	Quarterly GDP interpolated to monthly data	GDP

4. Data Analysis

4.1. Dispersion of Data

Appendix 1 illustrates the descriptive statistical analysis which has been directed to diagnose the distribution of observations considered in the research. The negative skewness confirmed the left-tailed distribution, and the positive skewness confirmed the right-tailed distribution. The results of the Jarque-Bera test reject H_0 for all the observations (Rejected H_0 since the P-value (0.00) < 0.05). It indicates the non-normal distribution of all the variables. As per the suggestions of the Box-Cox transformation, the natural log transformation has been used to obtain a constant variance for the series of data of each variable, and the duly transformed data has been used for further analysis.

4.2. Analysis of Trends in Data

Economic time series data mostly consist of unique characteristics such as the clear trend of shocks and high volatility throughout a specific period [58].

In the trends of the variables considered in the study, ASPI has structural breaks for both intercept and trend. There is a rapid growth recorded in the 2009 – 2010 period, followed by a continuous decline. The ASPI data distribution is heteroskedastic in its nature, which has unexpected shocks within the market. The trend analysis of CCPI shows a high variation of price levels with structural breaks in the trend within the Sri Lankan economy. FER, GDP, and MS show a smooth trend with the least shocks. These variables are gradually increasing with time. However, for OP, GP, and TB, there are structural breaks for both intercept and trend. However, when analyzing the distribution of data, it can be concluded that there is a possibility to exist an autoregressive character among all the independent variables. So, the lagged values of the time series data can be considered to conduct this study.

4.3. Unit Root Test for Data

As per the results illustrated in table 3 for both the Augmented Dickey-Fuller Test (ADF Test) and Phillips – Perron Test (PP Test), the log value of ASPI (LN_ASPI) at levels I (0) shows a significant t-statistic under 95% of confidence. Further, the inflation (CCPI) rejects the null hypothesis at levels I (0) in the ADF test with a 5% critical value and at the first difference I (1) under the PP test.

The natural log values of GDP (LN_GDP), GP (LN_GP), OP (LN_OP), MS (LN_MS), (LN_FER), and the treasury bill interest rate (TB), show a significant t-statistic under 5% of critical level and rejected null hypothesis at the first difference I (1), for both PP and ADF tests. Accordingly, stationarity is available among all the independent observations at I (1).

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***Table 3.** Results based on 5% Critical Value (CV) for Unit Root Test.*

Variable	ADF results			PP results		
	Level	I (1)	P	Level	I (1)	P
LN_GDP		-3.1989	0.0215		-7.45525	0.0000
CCPI	-4.1801		0.0009		-4.09160	0.0012
LN_GP		-12.8824	0.0000		-12.84625	0.0000
LN_OP		-11.0205	0.0000		-10.77596	0.0000
LN_MS		-10.1131	0.0000		-11.03863	0.0000
TB		-5.8368	0.0000		-13.49213	0.0000
LN_FER		-23.1743	0.0000		-27.35728	0.0000
LN_ASPI	-2.9073		0.0462	-2.6803		0.0791
1% CV	-3.4615	-3.4613		-3.4612	-3.46133	
5% CV	-2.8751	-2.8751		-2.8750	-2.87506	
10% CV	-2.5741	-2.5741		-2.5740	-2.57405	

4.4. Correlation Coefficient Matrix

The correlation was calculated between LN_ASPI and other observed variables to obtain an initial idea about the possible relationships between variables. When analyzing the correlation coefficient between the log values of ASPI and other observed variables, the coefficients are much more significant for some of the variables.

CCPI shows a moderate and negative relationship (-0.531) with LN_ASPI. Further, LN_OP (0.814), LN_GP (0.939), LN_MS (0.896), LN_FER (0.774), LN_GDP (0.918) shows a strong and positive correlation with LN_ASPI.

However, the interest rate (TB) shows a weak and negative relationship with LN_ASPI (-0.370).

Further, all the independent variables show multicollinearity among each other. The issue of multicollinearity among the independent variables may cause to create a spurious model. Thus, it was decided to factor in the highly correlated variables

through multivariate factor analysis [32].

4.5. Test Appropriateness of Data for Factor Analysis

The Bartlett test was conducted to identify whether at least one batch variance is different from the others. Table 4 illustrates the Bartlett test result, which emphasizes the rejection of H0 since the chi-square statistic, which is 2739.505, is significant under a 95% confidence level and concluded that the $\sigma_i^2 \neq \sigma_j^2$ for at least one pair.

The KMO statistic for the observed variables is calculated to assure the sampling adequacy to continue a factor analysis for this study. Accordingly, the KMO statistic is 0.736, which is above the thumb rule of 0.6. Thus, it concludes that the sample size of observed variables is sufficient to continue the study based on factor analysis.

Table 4. Results of Bartlett's Test & KMO Statistic.

Chi-Square Statistic – Approximate	2739.505
Degree of Freedom	21
Sig.	0.000
The Measure of Sampling Adequacy based on KMO Statistic	0.736

4.6. Extraction of Factors

The extraction of factors has been done based on the Principal Component Factoring (PCF) method, and

components with eigenvalues >1 are considered the factors for the study. Two components have been concluded as common factors that have eigenvalues greater than one. Accordingly, parallel to the seven (07) observed variables, two common factors have been finalized with 90.39% of the variance. The two factors extracted were rotated using three orthogonal rotation methods to get the significant factors and to check whether there is any invariance among the loadings once the components are rotated. The loadings, which are >0.5, have been highlighted in tables 5 and 6.

The variables included in factor 1 directly impact determining economic growth [59-61]. Thereby, factor 1 was identified as an Economic Growth Factor. The inflation rate and interest rate are key denominators of the time value of money [62-64]. Thus, factor 2 will be identified as the Time Value of Money Factor.

Since all the rotation methods proposed the same result, the final communalities of the two factors were obtained from the Varimax rotation method. The calculated final communalities are close to one, and the difference between initial and final communalities is close to zero. Accordingly, the 2-factor solution has been accepted to proceed with the study. Therefore, by using the factor coefficients, a linear combination is created for the factors identified using multiple linear regression. Accordingly, two common factors can be written as,

$$F1 = 0.237LN_{GP} + 0.252LN_{OP} + 0.211LN_{MS} + 0.197LN_{FER} + 0.219LN_{GDP} \tag{2}$$

$$F2 = 0.491CCPI + 0.540TB \tag{3}$$

F1 is considered as Economic Growth Factor while F2 is considered as the Time Value of Money Factor in the study.

Table 5. Factor Loadings with PCF and rotation for 2-Factor Model.

Rotation Method	Varimax		Quartimax		Equamax	
Initial Variable	1st Comp:	2nd Comp:	1st Comp:	2nd Comp:	1st Comp:	2nd Comp:
CCPI	-.268	.921	-.356	.890	-.268	.921
LN_GP	.964	-.165	.975	-.070	.964	-.165
LN_OP	.857	.125	.841	.208	.857	.125
LN_MS	.939	-.291	.963	-.197	.939	-.291
TB	-.052	.949	-.144	.939	-.052	.949
LN_FER	.883	-.283	.906	-.195	.883	-.283
LN_GDP	.951	-.264	.972	-.170	.951	-.264

Table 6. Summarized List of Variables of Each Factor under Each Rotation Method.

Rotation Method	Variables identified by the;	
	Factor 1	Factor 2
Varimax	LN_GP, LN_MS, LN_FER, LN_GDP, LN_OP	CCPI, TB
Quartimax	LN_GP, LN_MS, LN_FER, LN_GDP, LN_OP	CCPI, TB
Equamax	LN_GP, LN_MS, LN_FER, LN_GDP, LN_OP	CCPI, TB

4.7. Heteroscedasticity Test for Time-Series Data

The availability of the ARCH effect among observed data has been measured using the ARCH LM test.

Table 7. ARCH LM test.

F-statistic	15.913	P (F) (1,209)	0.0001
Observations x R^2	14.929	P (χ^2) (1)	0.0001

Accordingly, the H0 has been rejected with 5% significance level (P = 0.0001 < 0.05). So, the ARCH effect is existing among the considered observations (Table 7).

4.8. Partial Autocorrelation (PAC) and Autocorrelation (AC)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.981	0.981	207.69	0.000
		2	0.961	-0.016	408.07	0.000
		3	0.941	-0.001	601.37	0.000
		4	0.922	-0.017	787.58	0.000
		5	0.902	-0.014	966.76	0.000
		6	0.882	-0.012	1139.0	0.000
		7	0.862	-0.013	1304.3	0.000
		8	0.843	0.007	1463.1	0.000
		9	0.825	0.025	1616.0	0.000
		10	0.806	-0.053	1762.5	0.000
		11	0.786	-0.012	1902.7	0.000
		12	0.767	-0.001	2036.7	0.000
		13	0.746	-0.049	2164.3	0.000
		14	0.724	-0.066	2284.9	0.000
		15	0.701	-0.002	2398.7	0.000
		16	0.681	0.028	2506.4	0.000
		17	0.660	-0.026	2608.0	0.000
		18	0.641	0.061	2704.6	0.000
		19	0.623	0.003	2796.3	0.000
		20	0.606	-0.010	2883.3	0.000

Figure 1. Correlogram of Autocorrelation and Partial Correlation.

AC and PAC have been plotted to identify the own effect of LN_ASPI on the forecasting variable (dependent variable). As per figure 1, AC declines gradually with average speed, and PAC shows a single hike. Thus, it explains that the ASPI of last month is significant, and it will predict the ASPI of the current month. Accordingly, the model is a first-order auto-regression model - AR (1).

4.9. Generalized Autoregressive Conditional Heteroscedasticity Model (GARCH)

As per the results of AC and PAC, it is possible to conclude an autocorrelation among the variables until one lag. So, GARCH (1,1) model was developed based on one lag of LN_ASPI and Economic Growth Factor - F1 (and Time Value of Money Factor - F2) to study the rational relationship among independent and dependent observations.

The mean equation of the GARCH (1,1) model confirms that only the LN_ASPI of the previous month and the Time Value of Money Factors of the current month illustrate the significance of its coefficients through the probabilities of less than 5%. Accordingly, it was decided to enhance the model by eliminating the insignificant element (F1).

Table 8. GARCH (1,1) Model.

GARCH = C (4) + C (5) *RESID (-1) ^2 + C (6) *GARCH (-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
LN_ASPI (-1)	0.972698	0.005061	192.1852	0.0000
F2	-0.002979	0.000904	-3.294599	0.0010
C	0.259082	0.045966	5.636361	0.0000
Variance Equation				
C	0.000243	0.000135	1.798285	0.0721
RESID (-1) ^2	0.198871	0.062754	3.169031	0.0015
GARCH (-1)	0.745967	0.0822	9.074979	0.0000
R-squared	0.992881	Mean dependent var		8.143899
Adjusted R-squared	0.992813	S.D. dependent var		0.721057
S.E. of regression	0.06113	Akaike info criterion		-2.887778
Sum squared resid	0.780998	Schwarz criterion		-2.79278
Log-likelihood	312.1045	Hannan-Quinn criter.		-2.849382
Durbin-Watson stat	1.80931			

Based on the data from table 8, the coefficients for the conditional mean equation have been finalized with $\mu = 0.2590$ (p = 0.0000) for the constant parameter and $\phi 1 = 0.9726$ (p = 0.0000) for AR (1) parameter. The variables in the conditional mean equation are statistically significant, with a 95% confidence level. Further, the AR (1) parameter emphasizes that the ASPI of the previous month has 97.26% of sensitivity in determining the current month's performance of CSE. Also, the Time Value of Money Factor shows a negative influence in determining the current month's performance of CSE.

Further, the coefficients of the conditional variance equation also have been finalized with $\alpha 0 = 0.0002$, $\alpha 1 = 0.1989$, $\beta 1 = 0.7459$. The $\beta 1$ coefficient is also higher, explaining the volatility, which takes a long time to change

the market. The coefficient of $\alpha 1$ explains that ASPI's volatility is moderate and moderately responding to the market movement. Similarly, the prevalence of volatility shocks is confirmed among the ARCH coefficients (0.0002 + 0.1989 + 0.7459), closer to one.

4.10. Tests of Residuals

The study used White Heteroscedasticity Test, Ljung-Box Q Test, and Test of Normality of Errors to confirm residuals' homoscedasticity, lack of serial correlation among residuals, and normal distribution of residuals, respectively.

The White heteroscedasticity test accepts the homoscedasticity nature among the residuals with a probability of $0.9776 > 0.05$. Accordingly, it reveals

homoscedasticity among residuals in this model with a 95% confidence level. The Ljung-Box Q test considered ten (10) lags of the residuals of the model with a 95% confidence level. Accordingly, there was no serial correlation detected among the residuals. So, the model has captured all the information that pertains to the market.

The residual distribution has been assessed, and as per normality test results for residuals, the mean of residuals is approximately zero. Further, the skewness of the distribution (0.08), which is closer to zero and kurtosis is 3.7187, respectively, signals a normal distribution of residuals. Similarly, the Jarque-Bera test confirms the symmetrical distribution of residuals (P (0.09) >0.05).

5. Conclusion

Since the Sri Lankan economy is anticipating positive changes, it is essential to detect the root causes of the volatility of the performance of the share market within the previous period and resolve the adverse influences on the stock exchange by implementing efficient economic policies.

The objective of this study is to identify the impact of macroeconomic factors on the performance of the Colombo Stock Exchange. The study considered Inflation Rate, Gold Prices, Crude Oil Prices, Money Supply, Treasury Bill Rate, Foreign Exchange Rate, and Gross Domestic Production as the desired macroeconomic variables and derived two common factors using the exploratory factor analysis method.

The first factor includes Gold Prices, Crude Oil Prices, Money Supply, Foreign Exchange Rate, and Gross Domestic Production; identified as the economic growth factor. While the second factor includes the inflation rate and treasury bill rate and is identified as the time value of money factor.

The current study emphasizes that the effect of the previous month's ASPI is highly influential in determining the stock exchange performance. This emphasizes that the Colombo Stock Exchange is sensitive to bull market trends. Thus, the investors can obtain higher benefits by responding to the bull market trends in CSE.

H1a: There is a significant impact from macroeconomic factor 1 (economic growth factor) on the performance of the share market.

The findings of the study reject the alternative hypothesis for the economic growth factor. Thereby, it is confirmed that the volatility of the variables included in the economic growth factor (gold price, oil price, money supply, exchange rate, and gross domestic production) is not impacting to deviate the performance of CSE. Further, the GARCH (1,1) model confirmed that there is no long-term equilibrium between the ASPI and Economic Growth Factors.

Prior studies revealed a significant association between share market performance and independent macroeconomic variables such as gross domestic production, interest rates, foreign exchange rates, and inflation rate [46, 47, 49, 57]. However, the current study confirmed that, when considering the volatility of gold price, oil price, money supply, exchange rate, and gross domestic production together as a common factor, those have no significant influence on share market performance.

H1b: There is a significant impact from the macroeconomic factor 2 on the performance of the share market.

When considering factor 2 which is the Time Value of Money Factor, the current study revealed a significant and negative relationship between the Time Value of the Money Factor (i.e., inflation rate, and Treasury bill rate) and CSE performance. Thereby, findings directed to accept the alternative hypothesis derived for factor 2.

Accordingly, the study emphasized that collectively having a low level of inflation rate and treasury bill interest rate is a motivating factor for share market performance. Parallelly, these findings are equivalent to other research findings in different contexts [23, 37, 50, 65].

GARCH (1,1) model further confirms the prevalence of volatility shocks in CSE. Accordingly, the share market is responsive to the changes that occur in the market itself, inflation rate, and interest rate.

The results emphasize the importance of maintaining a stable internal value of the currency unit. Also, speculative investors can actively perform in the Sri Lankan share market by paying attention to the variables included in the Time Value of Money Factor. Thus, effective management of these macroeconomic variables produces an opportunity for the Sri Lankan economy to develop an investor-friendly environment to attract more investors to the Sri Lankan capital market. Meanwhile, having a higher ASPI in the previous month is a sign of a bull market. Thus, it is a motivator for investors to enter the stock exchange.

The findings emphasized that it is essential to maintain a low inflation rate and low risk-free interest rate at the same time to enrich the performance of the Sri Lankan share market by maintaining a well-performing and high liquid capital market.

Having a low risk-free interest rate is a motivation for investors to enter the Sri Lankan stock exchange under low risk. Further, such a low-interest rate condition would expand the lending and borrowing conditions within the country. This would cause to increase in the performance of the listed companies and develop an uprising platform for investors to trade actively.

A low inflation rate could increase domestic savings by stabilizing the intrinsic value of the currency unit, and it will lead to motivating domestic individuals and corporate investors to trade within the stock exchange. Since developing countries commonly experience increasing price levels [43], investors need to draw their attention to the inflation trend of the country when they invest their money in the stock exchange. Further to the findings of the study, the current hyperinflationary condition could create a threatening environment to the performance of the Colombo Stock Exchange. Thereby, based on the findings, the current study recommends developing macroeconomic policies to maintain a low level of inflation and treasury bill interest rate to uplift the performance of the share market (ceteris paribus).

References

[1] S. A. Ross, "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory,* vol. 13, no. 3, pp. 341-360, 1976.

[2] N. Chen, R. Roll and S. A. Ross, "Economic Forces and the Stock Market," *Journal of Business,* vol. 59, pp. 383-403, 1986.

[3] R. C. Maysami, L. C. Howe and M. A. Hamzah, "Relationship Between Macroeconomic Variables and Stock Market Indices: Cointegration Evidence from Stock Exchange of Singapore's All-S Sector Indices," *Journal Pengurusan,* vol. 24, pp. 47-77, 2004.

[4] D. I. Dayaratne, "A Comparative study for pre and post war performance of Colombo Stock Exchange (CSE)," *Sabaragamuwa University Journal,* vol. 13, no. 1, pp. 43-55, 2014.

[5] E. F. Fama, "Efficient Capital Markets: a Review of Theory and Empirical Work," *Journal of Finance,* vol. 25, pp. 383-417, 1970.

[6] A. V. Megaravalli and G. Sampagnaro, "Macroeconomic Indicators and Their Impact on Stock Markets in Asian Countries: A Pooled Mean Group Approach," *Cogent Economics & Finance,* vol. 6, no. 1, pp. 01-14, 2018.

[7] T. S. Dissanayake and E. W. Biyiri, "The Impact of Internal Factors on Share Price: Reference to Hotel Industry in Colombo Stock Exchange," *Business and Management Research Journal,* vol. 7, no. 3, pp. 33-37, 2017.

[8] J. Gurley and E. Shaw, "Financial Aspects of Economic Development," *American Economic Review,* vol. 45, no. 4, pp. 515-538, 1955.

[9] E. S. Shaw, Financial Deepening in Economic Development, New York: Oxford University Press, 1973.

[10] M. Pagano, "Financial Markets and Growth: An overview," *European Economic Review,* vol. 37, pp. 613-622, 1993.

[11] Central Bank of Sri Lanka, "Monthly Economic Indicators," Central Bank of Sri Lanka, Colombo, 2022.

[12] K. K. Arulvel, S. Balaputhiran, S. Ramesh and B. Nimalathasan, "Market Efficiency or Not: A Study of Emerging Market of Colombo Stock Exchange (CSE) in Sri Lanka," in *International Conference on Leading beyond the Horizon: Engaging Future*, 2011.

[13] J. I. Daoud, "Multicollinearity and Regression Analysis," *Journal of Physics: Conference Series,* p. 949, 2017.

[14] A. S. Beavers, J. W. Lounsbury, J. K. Richards, S. W. Huck, G. J. Skolits and S. L. Esquivel, "Practical Considerations for Using Exploratory Factor Analysis in Educational Research," *Practical Assessment, Research, and Evaluation,* p. 18, 2013.

[15] L. R. Fabrigar, D. T. Wegener, R. C. MacCallum and E. J. Strahan, "Evaluating the Use of Exploratory Factor Analysis in Psychological Research," *Psychological Methods,* vol. 4, no. 3, pp. 272-299, 1999.

[16] R. J. Rummel, "Understanding Factor Analysis," *Journal of Conflict Resolution,* vol. 11, no. 4, p. 444–480, 1967.

[17] H. Abu-Libdeh and M. Harasheh, "Testing for Correlation and Causality Relationships between Stock Prices and Macroeconomic Variables: The Case of Palestine Securities Exchange," *International Review of Business Research Papers,* vol. 7, no. 5, pp. 141-154, 2011.

[18] W. F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance,* vol. 19, no. 3, pp. 425-442, 1964.

[19] J. Estrada, "Systematic Risk in Emerging Markets: The D-CAPM," *Emerging Markets Review,* vol. 3, pp. 365-379, 2002.

[20] P. Kristofik, "Application of CAPM for Investment Decisions in Emerging Countries," in *5th International Conference Financial Risks Management and Modeling*, 2010.

[21] B. Ake, "The Role of Stock Market Development in Economic Growth: Evidence from Some Euronext Countries," *International Journal of Financial Research,* vol. 1, no. 1, pp. 14-20, 2010.

[22] S. U. Badullahewage, "The Effects of Macroeconomic Factors on the Performance of Stock Market in Sri Lanka," *International Journal of Innovation and Economic Development,* vol. 3, no. 6, pp. 33-41, 2018.

[23] E. Kitati, E. Zablon and H. Maithya, "Effect of Macro-Economic Variables on Stock Market Prices for the Companies Quoted on the Nairobi Securities Exchange in Kenya," *International Journal of Sciences: Basic and Applied Research (IJSBAR),* vol. 21, no. 2, pp. 235-263, 2015.

[24] H. O. Bakar and Z. Sulong, "The Role of Financial Sector on Economic Growth: Theoretical and Empirical Literature Reviews Analysis," *Journal of Global Economics,* vol. 6, no. 4, 2018.

[25] M. O. Odedokun, "Alternative Econometric Approaches for Analyzing the Role of the Financial Sector in Economic Growth: Time-series Evidence from LDCs," *Journal of Development Economics,* vol. 50, no. 1, pp. 119-146, 1996.

[26] C. K. Choong, A. Z. Baharumshah, Z. Yusop and M. S. Habibullah, "Private Capital Flows, Stock Market and Economic Growth in Developed and Developing Countries: A Comparative Analysis," *Japan and the World Economy,* vol. 22, no. 2, pp. 107-117, 2007.

[27] S. Fethi and S. Katircioglu, "The Role of the Financial Sector in the UK Economy: Evidence from a Seasonal Cointegration Analysis," *Economic Research - Ekonomska Istraživanja,* vol. 28, no. 1, pp. 717-737, 2015.

[28] W. Angko, "The Determinants of Stock Market Volatilities in Ghana," *Research Journal of Finance and Accounting,* vol. 4, no. 13, pp. 146-165, 2013.

[29] V. Tripathi and R. Seth, "Stock Market Performance and Macroeconomic Factors: The Study of Indian Equity Market.," *Global Business Review,* vol. 15, no. 2, p. 291–316, 2014.

[30] A. Rashid, "Macroeconomic Variables and Stock Market Performance: Testing for Dynamic Linkages with a Known Structural Break," *Munich Personal RePEc Archive,* 2008.

[31] M. Nisa and M. Nishat, "The Determinants of Stock Prices in Pakistan," *Asian Economic and Financial Review,* vol. 1, no. 4, pp. 276-291, 2011.

[32] R. Kumar, "The Effect of Macroeconomic Factors on Indian Stock Market Performance: A Factor Analysis Approach," *IOSR Journal of Economics and Finance (IOSR-JEF),* vol. 1, no. 3, pp. 14-21, 2013.

[33] B. F. King, "Market and Industry Factors in Stock Price Behavior," *The Journal of Business,* vol. 39, no. 1, pp. 139-190, 1966.

[34] X. Duan, Principal Factor Analysis of Stock Market Sentiment, Hong Kong: The Chinese University of Hong Kong, 2007.

[35] J. Vergara and M. Serna, "Factor Analysis to Evaluate the Financial Performance of the Construction Industry in an Emerging Market: The Case of Colombia," *REVISTA DE METODOS CUANTITATIVOS PARA LA' ECONOM'IA Y LA EMPRESA,* pp. 52-70, 2018.

[36] E. F. Fama and G. W. Schwert, "Asset Returns and Inflation," *Journal of Financial Economics,* vol. 5, no. 2, pp. 115-146, 1977.

[37] G. Mandelker and K. Tandon, "Common Stock Returns, Real Activity, Money, and Inflation: Some International Evidence," *Journal of International Money and Finance,* vol. 4, no. 2, pp. 267-286, 1985.

[38] R. Geske and R. Roll, "The Fiscal and Monetary Linkage between Stock Returns and Inflation," *The Journal of Finance,* vol. 38, no. 1, 1983.

[39] T. K. Mukherjee and A. Naka, "Dynamic Relations between Macroeconomic Variables and the Japanese Stock Market: An Application of a Vector Error Correction Model," *Journal of Financial Research,* vol. 18, no. 2, pp. 223-237, 1995.

[40] G. W. Mohammad, A. Islam, M. S. Alam and M. K. Khan, "Effect of Macroeconomic Variables on Stock Market Performance of SAARC Countries," *Asian Economic and Financial Review,* vol. 7, no. 8, pp. 770-779, 2017.

[41] P. Bialowolski and D. Weziak-Bialowolska, "External factors affecting investment decisions of companies," *Economics Discussion Papers No. 2013-44,* 2013.

[42] S. Vanitha and K. Saravanakumar, "The usage of gold and the investment analysis based on gold rate in India," *International Journal of Electrical and Computer Engineering (IJECE),* vol. 9, no. 5, pp. 4296-4301, 2019.

[43] A. Shabbir, S. Kousar and S. A. Batool, "Impact of gold and oil prices on the stock market in Pakistan," *Journal of Economics, Finance and Administrative Science,* vol. 25, no. 50, pp. 279-294, 2020.

[44] M. Monjazeb and M. S. Shakerian, "The Effects of Gold Price and Oil Price on Stock Returns of the Banks in Iran," *Arabian Journal of Business and Management Review,* vol. 3, no. 9, pp. 86-91, 2014.

[45] K. K. Gokmenoglu and N. Fazlollahi, "The Interactions among Gold, Oil, and Stock Market: Evidence from S&P500," in *Procedia Economics and Finance*, Prague: University of Economics, 2015.

[46] H. M. Nijam, S. M. Ismail and A. M. Musthafa, "The Impact of Macro-Economic Variables on Stock Market Performance; Evidence From Sri Lanka," *Journal of Emerging Trends in Economics and Management Sciences (JETEMS),* vol. 6, no. 2, pp. 151-157, 2015.

[47] S. J. Francis and M. Ganeshamoorthy, "Impact of Major Macro Economics Variables on Stock Prices in Sri Lanka," in *International Research Symposium*, Mihinthale: Rajarata University of Sri Lanka, 2015.

[48] G. B. Wickremasinghe, "Macroeconomic Forces and Stock Prices: Some Empirical Evidence from an Emerging Stock Market: Working Paper 14," School of Accounting & Finance, University of Wollongong, 2006. [Online]. Available: https://ro.uow.edu.au/cgi/viewcontent.cgi?article=1029&context=accfinwp. [Accessed 2020].

[49] L. C. Menike, "The Effect of Macroeconomic Variables on Stock Prices in Emerging Sri Lankan Stock Market," *Sabaragamuwa University Journal,* vol. 6, no. 1, pp. 50-67, 2006.

[50] P. M. Perera, "Macroeconomic Variables Effect on All Share Price Index in Colombo Stock Exchange of Sri Lanka," *International Journal of Scientific and Engineering Research,* vol. 6, no. 6, pp. 960-961, 2015.

[51] D. Weerakoon, U. Kumar and R. Dime, "Sri Lanka's Macroeconomic Challenges," *ADB South Asia Working Paper Series,* 2019.

[52] U. S. Kumara, W. A. Upananda and M. U. Rajib, "Do Dynamic Properties of Stock Return Vary Under Hostile Environment? A Study During and After the Ethnic Conflict in Sri Lanka," *Ruhuna Journal of Management and Finance,* vol. 1, no. 2, pp. 29-40, 2014.

[53] M. Barigozzi, "Dynamic Factor Models," 2018. [Online]. Available: http://www.barigozzi.eu/MB_DF_lecture_notes.pdf. [Accessed 2021].

[54] T. G. Peiris, Handbook on Analysis of Multivatiate Date Using SPSS, Piliyandala: Central Print, 2018.

[55] M. Friendly, "Exploratory and Confirmatory Factor Analysis," 2008. [Online]. Available: https://www.datavis.ca/courses/factor/efacfa-handout2-2x2.pdf. [Accessed 2022].

[56] A. Shastri, "Sri Lanka in 2002: Turning the Corner?," *Asian Survey,* vol. 43, no. 1, pp. 215-221, 2003.

[57] J. D. Jayasundara, R. A. Rathnayake and J. S. Fernando, "Impact of Macroeconomic Variables on Stock Market Performances: Evidence from Sri Lanka," *Journal of Business Economics,* 2019.

[58] M. B. Shrestha and G. R. Bhatta, "Selecting Appropriate Methodological Framework for Time Series Data Analysis," *The Journal of Finance and Data Science,* vol. 4, pp. 71-89, 2017.

[59] H. U. R. Khan, "The Impact of Oil and Gold Prices on the GDP Growth: Empirical Evidence from a Developing Country," *International Journal of Management Science and Business Administration,* vol. 1, pp. 34-46, 2015.

[60] P. Chaitip, K. Chokethaworn, C. Chaiboonsri and M. Khounkhalax, "Money Supply Influencing on Economic Growth-wide Phenomena of AEC Open Region," in *Procedia Economics and Finance*, Kazan, Russia, 2015.

[61] A. H. M. Y. Chowdhury, M. K. Hamid and R. A. Akhi, "Impact of Macroeconomic Variables on Economic Growth: Bangladesh Perspective," *Information Management and Computer Science,* vol. 2, no. 2, pp. 19-22, 2019.

[62] M. J. Chandra and M. L. Bahner, "The Effects of Inflation and the Time Value of Money on Some Inventory Systems," *International Journal of Production Research,* vol. 23, no. 4, pp. 723-730, 1985.

[63] M. Fierko, S. Lauer and D. Scarpetta, "Chapter 10: Interest Rates and Time Value of Money," University of Florida, 2000.

[64] M. Kaveh and V. M. Dalfard, "A Study on the Effect of Inflation and Time Value of Money on Lot Sizing Spite of Reworking in an Inventory Control Model," *Technical Gazette 19,* pp. 819-826, 2012.

[65] A. Fernando, "Macroeconomic Impact on Stock Market Returns and Volatility: Evidence from Sri Lanka," *Business and Economics Journal,* vol. 9, no. 4, 2018.