EFFECT OF MACROECONOMIC VARIABLES TO DETERMINE THE SHARE MARKET PERFORMANCE IN SRI LANKA

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DECLARATION

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ABSTRACT

The stock exchange is considered an economic barometer that emphasises the economic condition of any country. The rise or fall of share prices indicates an economic boom or recession cycle. The better performance of the share market attracts the attention of investors and the exchange of shares continues the process of reinvestment and disinvestment which leads to economic growth via capital formation. The diminishing performance of the share market adversely impacts the creation of investments. It directly impacts economic growth as a component of aggregate demand and as a deterministic factor of the productive capacity of the economy. Thus, the study focused on identifying the effect of macroeconomic variables on the performance of the share market which would attract the attention of economic policy-makers in terms of enhancing the investments within Sri Lanka. The study focused on few key macroeconomic variables as in inflation rate, money supply, treasury bill rate, crude oil prices, gold prices, foreign exchange rate, and analysed the performance of All Share Price Index (ASPI) with those variables. The quantitative research approach was applied for the monthly data collected for 213 months from January 2002 – September 2019. Two factors were derived using Principle Component Factoring as Economic Growth Factor and Time Value of Money Factor. Based on both econometric and time series analysis, the study developed the Vector Autoregressive (VAR) model and the GARCH (1,1) model to analyse the performance of ASPI. The results of VAR model revealed that ASPI data for past months, and time value of money factor which includes inflation and treasury bill rate is more deterministic when analysing the performance of Sri Lankan stock exchange. GARCH (1,1) model also confirmed the same result in its conditional mean equation. However, the economic growth factor shows insignificant result in both the models in relation to the performance of Colombo Stock Exchange.

Keywords: Macroeconomic Variables, Share Market Performance, Vector Autoregressive, GARCH (1,1), Sri Lanka

DEDICATION

I dedicate this to

my mother

who

dedicated her all happiness

to make me a wilful and valuable person

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Table of Contents

List of Figures

List of Tables

List of Abbreviations

ACF	Auto Correlation Function
ADF Test	Augmented Dickey-Fuller Test
AIC	Akaike Information Criterion
APT	Arbitrage Pricing Theory
AR Model	Autoregressive Model
ARCH	Autoregressive Conditional Heteroscedastic
ASPI	All Share Price Index
CAPM	Capital Asset Pricing Model
CBSL	Central Bank of Sri Lanka
CCPI	Inflation Rate/ Colombo Consumer Price Index
CSE	Colombo Stock Exchange
CV	Critical Value
DF	Dickey-Fuller
EMH	Efficient Market Hypothesis
FER	Foreign Exchange Rate
FPE	Final Prediction Error
GARCH	Generalized Autoregressive Conditional Heteroscedasticity
GDP	Gross Domestic Production
GP	Gold Prices
HQ	Hannan-Quinn Information Criterion
IR	Interest Rate

KMO	Kaiser-Meyer-Olkin Statistic
LKR	Sri Lankan Rupees
LN_ASPI	Log Values of ASPI
LN_FER	Log Value of Foreign Exchange Rate
LN_GDP	Log Values of Gross Domestic Production
LN_GP	Log Value of Gold Price
LN_MS	Log Value of Money Supply
LN_OP	Log Value of Oil Price
MLF	Maximum Likelihood Factoring
MS	Money Supply
NKQ	New Keynesian Q theory
NSE	Nigerian Stock Exchange
OLS	Ordinary Least Square
OP	Crude Oil Prices
PACF	Partial Auto Correlation Function
PAF	Principal Axis Factoring
PCA	Principal Component Analysis
PCF	Principal Component Factoring
PP Test	Phillips – Perron Test
QTM	Quantity Theory of Money
S&P 20	S&P Sri Lanka 20 Index
SAARC	South Asian Association for Regional Cooperation
SEC	Securities & Exchange Commission

SIC	Schwarz Information Criterion
TB	Treasury Bill Interest Rate
VAR	Vector Autoregressive
VECM	Vector Error Correction Model

CHAPTER 01

INTRODUCTION

1.1 Introduction to the Chapter

A crucial factor that emphasises the development of any economy is its ability to smoothly function the stock exchange. Therefore, paying attention to the share market performance has become a prominent factor when achieving a promising growth within the Sri Lankan economy (Dissanayake & Biyiri, 2017; Gurley & Shaw, 1955; Shaw, 1973). This study focuses on analysing the stock exchange performance parallel to the changes that occur among Sri Lankan macroeconomic factors. This chapter will develop a rationale background for research while defining the research gap and setting objectives, questions, significance, and limitations.

1.2 Introduction to Study

1.2.1 Theoretical background

Development of the financial sector had been pivotal when determining the economic growth of a country. Different economies debated this relationship between the financial and economic growth as a leading subject throughout the centuries. Accordingly, numerous empirical and theoretical studies were conducted to develop a rationale relationship between these two factors (Gurley & Shaw, 1955; Shaw, 1973).

Financial intermediaries and financial markets are the two broad divisions of a financial system. Banks, pension funds, other funds, insurance companies, and investment companies are the worlds' leading financial intermediaries. Further, markets in which trade stocks, bonds, and other financial instruments are the leading functions of financial markets in the world.

These financial intermediaries and markets convert a significant proportion of savings of the economy to productive investments. So, an economy could accomplish a higher

rate of capital accumulation by having an efficient financial system. Thus, it assures long-term growth and sustainable performance in an economy.

Once the economies let the emerging markets boom, it attracts global attention towards the link between stock exchange performance and economic fundamentals. As per the Arbitrage Pricing Theory (APT), an underlying asset's pricing should be done based on their exposure to the economic variables (Ross, 1976; Chen, Roll, & Ross, 1986).

As per the Efficient Market Hypothesis (EMH), the price of certain security should reflect the overall picture of that particular security. An aggressive price adjustment of stock leads to creating frequent new information and has been addressed as an effective capital market (Fama, 1970). Further, EMH emphasis that the new and relative information can be used to determine the stock market movements and to predict share prices than the past information (Fama, 1970).

While affirming the conclusion of EMH, Maysami, Howe, & Hamzah, (2004) emphasised that it is possible to forecast the time series of stock prices using the key macroeconomic variables.

As per the multi-factor asset pricing model, APT categorises the risk inherent with an underlying asset into two segments as systematic risk and unsystematic risk. The risk inherent to the particular market or the non-diversifiable risk is also known as the systematic risk. Accordingly, the systematic risk mostly results with an internal factor, while measuring risk premium depends on the external factors that may influence the asset's return. However, in APT, neither the risk deterministic factors nor the type of risk determinants individually would decide the underlying asset's price. Therefore, the theoretical gap between the Asset Pricing Problem and current stock exchange phenomena causes research on stock markets' performance in different periods.

1.2.2 The securities exchange

Securities exchange is a pivotal market place that the buyers and sellers of financial instruments exchange their ownership of financial assets to a price agreed upon by both the parties. Thus, it facilitates to assure the mobilisation of capital in every

economy. Further, the stock market is also referred to as a "Financial Market," which trades the listed companies' financial instruments (Mishkin & Eakins, 2011). An efficient equity market leads the companies more flexible in raising capital for their businesses by issuing securities.

It is proven that the share market is pivotal within the financial systems, and its importance towards the economy has risen throughout the last few decades. In the domestic economy and the world economy, the stock market has become a leading dynamic force that drives the economic system while providing advanced information about the economy.

As per Megaravalli & Sampagnaro, (2018), stock markets in different nations have provided investor-friendly opportunities to foreign investors. As a result of the sustainable political and legal environment, the growing markets maintained their performance significantly while creating an investor-friendly environment for foreign investors. Accordingly, as a dominant market indicator, financial instruments' prices have responded to the macroeconomic variables' fluctuations. So, there is a high possibility of maintaining a precise link between macroeconomic variables and stock exchange performance.

Market capitalization is the key denominator that is used widely in measuring the performance of a share market. It is the cumulative worth of the outstanding shares of listed companies in a stock exchange. So, the market capitalization indicates the public net worth of stocks of all the companies listed in the stock exchange. The listed companies were categorized into three groups: large, mid, and small-cap based on market capitalization. Prior research has used market capitalization as a performance indicator when measuring stock exchange performance in different economic contexts (Angko, 2013; Mondal & Imran, 2010; Tripathi & Seth, 2014). Similarly, the All Share Price Index (ASPI), an index developed based on market capitalization, is also a key indicator of a share market's performance, which depicts the share market's net growth daily.

In terms of performance, the Asian finance market could obtain the whole world's attention in the last few decades while providing attractive investment opportunities. The Asian finance market was considered a growing market that was effectively performed after the regional countries' liberalization (Megaravalli & Sampagnaro, 2018). The well-performing and liquid stock market may minimize the effect of unsystematic risk while improving the marginal productivity of Capital (Pagano, 1993). However, there can be many factors that affected stock exchange performance.

The connection among the macroeconomic variables and the stock exchange performance helps policy-makers overall effect of understand the current and upcoming policies on the share market performance. Further, the research findings may help the investors to make effective investment decisions with better understanding. Thirdly, it is possible to minimise the effect of the shock factor that may occur due to the fluctuations in the financial market and the economy by making awareness among the public to take protective measures (Abu-Libdeh & Harasheh, 2011).

Figure 1.1: Trend of ASPI in CSE (2002 - 2019)

The ASPI of the Colombo Stock Exchange (CSE) was analysed from January 2002 to May 2019, that the government changes occurred parallel to the frequent economic changes. The researcher only considered the period until May 2019, the forthcoming month of the Easter attack, which was incurred on the 21st of April 2019. ASPI shows a mild growth within 2002 – 2009. An exponential growth can be seen in ASPI after

2009, when the Sri Lanka ceased its civil war condition. However, the share market indicators revealed a considerable decline within the performance of the CSE throughout 2011 - 2012 (Figure 1.1). Further, the stock exchange performance decrease has drastically dropped the share prices, which lead to demotivate the investors. This has challenged the financial health of many companies listed in CSE.

1.3 Problem Statement

CSE is the marketplace that facilitates domestic and foreign investors to trade their investment assets (Shares and Credit Instruments) of the listed companies to benefit from capital gains.

The secondary market creates additional economic value by promoting more beneficial transactions within the economy to lower transactional costs. Through this, the companies listed within CSE get an opportunity to uplift their market value. Many economic fundamentals, prospects of the companies, and industries may sensitively impact share indices' movements.

There are two major theories of equilibrium pricing of securities as in (01). Capital Asset Pricing Model (CAPM), which only considers the non-diversifiable risks when valuing investment assets (Sharpe, 1964; Markowitz, 1952) and (02). APT considers both micro and macro factors when valuing the securities (Ross, 1976). Thus, APT gives proper justification for the impact of economic factors on the stock exchange performance.

When analysing the performance of share market indicators since 2002 (Figure 1.1), it is noticeable that there is a considerable drop in those indicators within the last few years. This decline has caused to block the frequent investors' liquidity, leading to high capital losses.

CSE data within the last decade convinced that the primary market dealings and secondary market dealings have been drastically varied. Such variations have affected adversely on the investment decisions of speculative investors. This behaviour causes to demotivate the domestic and foreign investor of the country.

Table 1.1: Primary and Secondary Market Dealings of Sri Lanka in the Last Decade

	Rate of Annual Growth (%)									
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Primary Market Dealing	20.10	(0.90)	17.20	45.80	(12.60)	(12.00)	(4.40)	(20.40)	13.10	(10.20)
Secondary Market Dealing	14.00	(0.30)	11.50	9.00	57.10	(1.90)	27.80	42.90	(22.30)	(10.50)

Source: Annual Reports of the Central Bank of Sri Lanka (CBSL)

As per figure: 1.1, the diminishing stock exchange performance further signalled that the country's economy is moving towards a possible recession. So, the authorities may have to focus on the root causes of the stock exchange's adverse behaviour for soon recovery while efficiently managing the economic policies.

Parallelly, the growth rates of primary market dealings and secondary market dealings published by the CBSL (Table 1.1) confirm that the primary market dealings have grown until 2012, and later it has decreased continuously. It means the companies have reduced the introduction of new investment instruments to the stock market. Also, the secondary market dealing has shown considerable growth from 2009 to 2013. The dealings within the secondary market also have decreased after 2013. These market changes emphasised that the operations in both financial markets have reduced within the last few years. Such changes could create capital deficiencies within the economy and could adversely affect the share market's operations.

The Sri Lankan government always focuses on economic growth. However, the changes that occur within the political environment change the country's macroeconomic policies frequently. Thus, ASPI's behaviour within 2009 to 2012 (Figure 1.1) signals that the APT's significant effect (Ross, 1976) in determining the stock market's performance.

Since the economy is focusing on changing its policies to enhance productivity in the recent past (CBSL, 2020), there is a timely requirement to recognize the key macroeconomic aspects that affect the stock exchange's performance. It helps to set up an investor supportive environment within the country to resolve the blocked liquidity condition within the Sri Lankan economy by grooming the share market. Since the

economy is anticipating positive changes, it is essential to detect the root causes for the share market's poor performance within the previous period and identify the factors affecting such behaviour that could be resolved.

Accordingly, this research's practical gap will be filled by identifying the effect of the key macroeconomic aspects on the stock exchange performance in Sri Lanka. If the economy can fully manage the duly recognized factors favourably, it would help the country overcome this condition rapidly.

1.4 Research Objectives

To identify the effect of the key macroeconomic aspects for the performance of CSE.

1.5 Research Hypothesis

Hypothesis I

H_0: There is no significant impact from the considered macroeconomic variables individually on the performance of CSE

H_1: There is a significant impact from the considered macroeconomic variables individually on the performance of CSE

Hypothesis II

H_0: There is no significant impact from the considered macroeconomic variables collectively on the performance of CSE

H_1: There is a significant impact from the considered macroeconomic variables collectively on the performance of CSE

1.6 Significance of the Study

As per Sharpe, (1964); Fama, (1970); Ross, (1976), Asset Pricing Problem has different facets, and different internal and external factors may influence in determining the price of an investment asset. Thus, the current phenomena in CSE will be rationally evaluated through this study to understand the impact of economic factors

on the pricing of investment assets. Further, this study's findings could be used in developing rationale discussions about the share market performance and economic growth.

Further, EMH (Fama, 1970) emphasizes maintaining a low correlation between share market indices and publicly available data, always beneficial for portfolio diversification. The conclusions of this research could help the shareholders and portfolio managers when diversifying their portfolios.

The investors may consider many external environmental factors when making an investment decision in the Sri Lankan economy. Further, it has already been highlighted that there is a significant requirement of attracting more investors to the economy. The well-performing share market causes circulating investments within the financial system; thus, it increases the corporates' net worth in CSE.

So, the study focuses on identifying the macroeconomic factors which are significantly affecting the stock exchange performance. Based on the findings, the economists could concentrate on creating an investor-friendly environment within the country. Economists can use the results when setting up their economic policies to assure the CSE's best performance, emphasizing and eliciting economic systems' stability.

1.7 Limitations of the Research

This study is carried out by considering only the major macroeconomic factors in the economy. Therefore, other variables that influence the stock market indices have been neglected, and it will impact the results in measuring the effect of these variables on price indices.

Fluctuations of the considered variables are not always determined based on the market forces. Some variables, such as exchange rate and interest rate, vary due to the political and economic policy decisions. Such variations cause to weaken the findings of the study with the reality of the economic environment.

This research study uses the econometric and time series analysis to identify the impact of macroeconomic variables on the share price index. However, there can be different models to measure the relationship between the considered variables.

1.8 An Outline of Subsequent Chapters

Chapter 01 – Introduction

A rational background for the research will be developed through this chapter.

Chapter 02 – Review of Literature

The theoretical background and the research's empirical background will be discussed to identify the research model's variables.

Chapter 03 – Methodology

Research design, data collection, and methods used to analyse data will be discussed to develop the next chapter's plan.

Chapter 04 – Analysis of Data

The statistical analysis and interpretations of results will be made in this chapter.

Chapter 05 – Conclusion

Based on the results obtained, the research conclusion can be drawn to achieve the research objectives set in chapter 01.

CHAPTER 02

REVIEW OF LITERATURE

2.1 Introduction to the Chapter

This section addresses a critical overview of the recent prior literature, which has been gathered in share market performance in different economic backgrounds. Accordingly, this section initially discusses the variables that could affect the financial markets and the empirical findings for the identified variables in developed and emerging economic contexts to emphasize the research gap. Finally, the discussion will conclude while emphasising the importance of conducting the research currently.

2.2 Role of the Financial Sector in the Economy

An efficient financial system is the key coordinator of the financial intermediation of an economy. It attracts investors and savings and provides loans to the needy, filling the surplus and deficits of funds. Further, it transfers excessive funds to production sectors, which allocate the resources efficiently and increase the economy's productivity.

Accordingly, financial development has motivated economic growth by improving marginal productivity while increasing capital accumulation efficiency (Bakar & Sulong, 2018).

Odedokun, (1996) found that 85% of countries sampled in their study has achieved economic growth through successful financial intermediation. It highlights that promoting financial intermediation is a predominant fact for the growth in any country.

2.3 Development of the Stock Exchange and Economic Growth

Choong, Baharumshah, Yusop, & Habibullah, (2007) stated that the stock exchange is a significant element of a financial sector that motivates the capital inflows; thus, affects economic growth.

As per Fethi & Katircioglu, (2015) 's findings, the stock exchange is highly influential towards the economy's output. A causality relationship has been investigated between economic growth and share market considering economic statistics for 1995 – 2008 among five European countries, and Granger causality test results have revealed a causality association among economic growth and development of share market (Ake, 2010).

2.4 Share Market and Its Performance

The stock exchange is a crucial centre that buyers and sellers exchange their securities for a pronounced price. So, the stock exchange can be a useful indicator that measures the economic condition of the country. Accordingly, the behaviour of share prices indicates the economic boom and the recession of any economy.

The valuation of the securities of a stock exchange is based on the demand and supply of shares. The high demand for shares of growth-oriented companies makes continuous profits and increase the value of their shares. This process motivates the disinvestment and reinvestment culture within the economy, which leads to capital formation. Healthy speculation of financial instruments traded in the share market assures the investors of the securities' liquidity level. Thus, it's essential to have a stock exchange with proper functioning.

In most of the prior research, share market price indices and market capitalization, or any other similar indices, have been used to analyse the Stock Exchange performance (Alam & Uddin, 2009; Thishanthi & Silva, 2015; Kitati, Zablon, & Maithya, 2015; Mohammad, Islam, Alam, & Khan, 2017).

2.4.1 All Share Price Index (ASPI)

Since 1985, CSE has calculated this index to measure the performance of stocks. It is a key indicator that is being used to analyse the performance of share in CSE. CSE considers 1985 as the base year, which equals 100 when calculating ASPI (Thishanthi & Silva, 2015; Badullahewage, 2018). It measures the daily performance of all the

shares traded in the stock exchange. Throughout past years, ASPI has played a key role in depicting CSE's performance within the Sri Lankan Economy.

When analysing ASPI's behaviour from 2002 – 2019 (Figure 1.1), the index is considerably lower than the current condition. However, after 2009, when Sri Lanka cease its war condition, the level of investments attracted to the CSE has exponential growth. However, later in 2012, the performance of CSE has decreased drastically. Though the CSE uplifted its performance lately, it has not recorded any noticeable growth within the last few years.

2.5 Factors Affecting the Share Market Performance

2.5.1 Investor decision making

Financial theories consider the CAPM (Sharpe, 1964) a widely accepted tool to estimate the discounting rates to identify an investment asset's fair value. This model has commonly used in corporate finance to define the discount rate of a project. While analysing the risk function, which is called beta, CAPM values the investment without considering the investor preference and the expected return of any underlying asset. Since beta measures an asset's risk, it can explain the returns of a cross-section of such assets by analysing such underlying assets' relative beta values (Estrada, 2002).

CAPM is considered an equilibrium model used as a tool for valuing projects and making decisions. 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) (Kristofik, 2010). However, when valuing the risk premium, CAPM uses the Mean-variance of the portfolio. Accordingly, CAPM only considers the portfolio specific risk factors when valuing the returns expected from a given underlying asset which has been challenged lately.

Fama (1970) stated that CAPM's capital market efficiency is not that specific in the practical context. The equilibrium expected returns could be formed based on the information or information sequence addressed as "fair game." Thus, the "fair game"

in efficient market model, which was used to derive an underlying asset's expected return, can make a more detailed statement about the economic environment.

In parallel to EMH (Fama, 1970), APT is classifying the risk related to an underlying asset into two as systematic risk and unsystematic risk. The unique risks to a company can be identified as an unsystematic risk component, and it can be diversified. However, systematic risk is the non-diversifiable proportion. Such risks always impact on changing the stock market performance; thus, it is unavoidable. So, the portfolio mean-variance has been considered a firm-specific factor. It was determining the systematic risk of an underlying asset (Ross, 1976).

There had been many researched conducted to study the contents of systematic risk, thus based on EMH (Fama, 1970), many researched focused on studying the impact of the macroeconomic environment of different economies towards the performance of the stock exchanges (Ake, 2010; Badullahewage, 2018; Kitati, Zablon, & Maithya, 2015).

2.6 Macro Environment and Variables

2.6.1 Inflation Rate (CCPI)

According to Kulatunge, (2017), the continuous increment of a particular country's general prices within a certain period is inflation, which is an unavoidable fact in any economy. However, low inflation creates a better environment for economic growth, which encourages investors and ultimately leads to an upsurge in the job market, which may uplift the living standards of the country's population.

In Sri Lanka, Colombo Consumer Price Index (CCPI) is the frequently used price index, which measures the fluctuations of the general prices at a given period. Many studies highlight that mild inflation is economic-friendly and leads to long-run economic growth and development (Mallik & Chowdhury, 2001; Kihangire & Mugyenyi, 2005).

Inflation diminishes the purchasing power of the local currency unit and reduces the real value of money. This condition impacts to create many discrepancies in the

economic environment, and it adversely affects the living standards of the fixed income earners (Colombage, 2005).

The inflation theories are formulated based on the demand-pull and cost-push theories. There are several causes of inflation that violate other macroeconomic variables (Bashir, 2011).

Colombage, (2005) has identified cost-push factors such as domestic production shortfalls, exchange rate depreciation, import price increments, and wage increments. At the same time, Bashir, (2011) emphasizes that an increment in the country's general price level may occur due to cost-push factors such as budget deficits and raising taxes.

However, demand-pull inflation occurs due to the expansion of monetary or fiscal policies (Mosayeb & Rahimi, 2009). Such will occur mainly due to the high-velocity circulation of money, which creates an excess demand for goods and services.

According to Lopez, (2018), New Keynesian Q (NKQ) theory develops a rational correlation that varies according to time among stock prices, investments, and inflation, mainly to forecast the stock prices based on investments that forecast the excess returns and inflation that forecast the risk-free rate. Though the NKQ develops a model between stock prices based on inflation, the connection among the share market's performance and inflation has been critically argued through the prior research findings.

A research was done by Megaravalli & Sampagnaro, (2018), based on Indian, Chinese, and Japanese economic systems. It has been concluded as a statistically negative but insignificant long-run association between share market indicators and inflation. However, the same research highlighted that there is an insignificant connection between the variables in the short-run. While supporting the same findings Angko, (2013) stated that inflation exerts an insignificant impact on share market performance in the Ghanaian economy. Aurangzeb, (2012) has also stated similar findings in his research, which is based on the stock exchanges in South Asia.

Findings based on the Nairobi Securities Exchange stated that inflation's net effect towards share prices are minimal (Kitati, Zablon, & Maithya, 2015). In contradiction to the above findings, the research conducted based on the Greece economy challenged, stating a significant adverse association between inflation and stock returns until 1995. After that, the relationship has been statistically insignificant due to monetary fluctuations (Spyrou, 2001). Misra, (2018) also supported the same findings based on the Wald Test and emphasized a short-run causality among the performance of stock exchange and inflation.

2.6.2 Gold Prices (GP)

The price of gold is a key denominator of economic health. When gold prices are high, it signals that the economy is not healthy. Investors purchase gold with speculation to earn benefits in the future, and most investors rely on gold if there is an economic crisis or high currency depreciation.

Thus, gold prices reflect the economic health for profit savvy investors. Many prior studies were accompanied to evaluate the behaviour of gold prices and responsiveness of stock exchanges towards those behaviours in the world.

As per prior research conducted, a negative correlation can be observed between gold prices and the stock exchange performance (Long, Duy, & Dang, 2017). This is a feasible condition since a rise in gold prices stimulates investments to flow into the gold market, attracting the majority of investors with a higher inflow of funds to the gold market. As a result of such substitution, the stock exchange performance may decline.

A long-term causality between the share market performance and gold prices has been identified within the Bombay Stock Exchange through the Vector Error Correction Model (VECM) (Misra, 2018; Patel, 2012). Further, Naik, (2012) revealed much significant relationship among gold prices & the stock market performance.

2.6.3 Crude Oil Prices (OP)

Crude oil is a key energy source consumed by the whole world. Thus, it is one of the key raw materials used by the majority of industries. The continuous fluctuations of oil prices have become a key determinant of many macroeconomic variables, including inflation, aggregate supply, and balance of payment (Cleaver, 2007).

Crude oil price is a highly influential supply-side factor, which impacts to determine the cost of production of the domestic economy. Thus, there is a possibility of incurring cost-push inflation through the increasing crude oil prices.

When analysing the factors affecting crude oil prices, Brevik & Kind, (2004) identified that demand, supply, and speculation of energy prices are the main causes that affect the oil price fluctuation in the international market.

However, inflation occurs due to the supply shocks that can create adverse effects on any country's economy (Khositkulporn, 2013). Krichene, (2008) also stated that increasing oil prices could create instabilities in equity, money, and foreign exchange markets.

However, based on Impulse Response Analysis, Tripathi & Seth, (2014) found that crude oil prices have a substantial and positive response to India's share prices. Further, they have examined a bi-directional causality between share market indices & oil prices. Subing, Kusumah, & Gusni, (2017) did Indonesia-based research and identified a significant positive effect among crude oil and share prices. The results agree with prior studies conducted by Witjaksono, (2010); Handiani, (2014).

Nandha & Faff, (2008) have conducted a study based on 35 industrial sectors to identify the effect of change in oil prices on equity prices. The findings revealed that the share prices of the companies listed as mining industries are positively responding to the volatility of crude oil prices. However, it shows a significant negative effect of oil prices on the share price volatility within the rest of the industries.

2.6.4 Money Supply (MS)

Money available for circulation within the society, which impacts increasing the number of transactions incur in the economy, is known as money supply. This leads to an increase in the output level of the country. Thus, it explains that when money supply rises faster, it may create economic growth or growth of national income. Further, it is possible to create inflation within the economy. Irvin Fisher explained this relationship within the inter-war years using "the Quantity Theory of Money (QTM) concept" (Cooray, 2008).

The key assumption that has been used in developing QTM was the predictability of the velocity of circulation of money (V). Moreover, it assumed to be remaining constant. Further, it assumed that monetary variables could not influence the real value of GDP. Based on these assumptions, a relationship is developed between the velocity of circulation of money (V), money supply (MS), the real value of the national output (Y), and price level (P).

$$MS \times V = P \times Y$$

Since the QTM assumed that MS and Y remain unchanged, increasing the price level parallel to MS's increment is possible. Thus, the multicollinearity effect could be seen in between the variables.

Friedman & Schwartz, (1963) have explained the association between MS and stock exchange performance. Thereby, it has been stated that the increase in MS would impact aggregate economic performance. Similarly, the deviation of aggregate economic performance causes to change the expected stock returns.

Many studies were available in the Asian context, which has tested the impact of MS on the stock exchange performance by using different approaches. Nepal based literature study has revealed a positive association among MS and the performance of the stock exchange (Rakhal, 2015). Shrestha & Subedi, (2014) support the above findings through their research while using the Ordinary Least Square (OLS)

regression method, which revealed a strong positive connection between the Nepalese stock exchange and MS by analysing the 2000 – 2014 period.

While supporting the above findings, Nisa & Nishat, (2011) have developed an econometric model to define the variables which determine Pakistan's stock prices. Thereby, it has revealed a positive and significant relationship among stock prices and the broad money supply. Further, it has convinced that the increase in MS may increase the stock prices by 40.319% within the Pakistan economy. Haque & Sarwar, (2012) have revealed a supportive finding through research conducted based on the Karachi stock exchange within 1998-2009 using a sample of 394 listed companies.

In contrast with the above findings, Tripathi & Seth, (2014) has studied the Indian stock exchange from 1997 – 2011 and identified that MS has a negative impact on market turnover. It used the factor-analysis approach to analyse the data while considering the money supply as an inflationary variable to minimize "multicollinearity."

Mohammad, Islam, Alam, & Khan, (2017) researched for the South Asian Association for Regional Cooperation countries (SAARC) by using the multivariate regression model to study the stock exchanges' responsiveness to the changes that occur within macroeconomic variables in the region. As per findings, share market indices and MS do not show any significant relationship within the SAARC region.

However, a study done based on the Singapore stock exchange has found that the property index and the Singapore stock market indices develop a co-integrating connection with the broad money supply (M2). Further, it has been found that short and long-term MS does not substantially affect the Singapore hotel index (Maysami, Howe, & Hamzah, 2004).

When analysing the Non-Asian context, a study based on the Nigerian economy has studied the impact of MS on the share prices using the data from 1985 – 2010. The study used the Engle-Granger co-integration test to analyse the data, and the findings revealed that the money supply does not significantly impact determining the share prices in the Nigerian economy using the economic data from 1984 – 2007 (Malaolu,

Ogbuabor, & Orji, 2013; Maku & Atanda, 2010). As per, Augmented Engle-Granger Co-Integration Test results, the Nigerian capital market is significantly responding towards the macroeconomic variables within the long run.

Further, research has conducted based on the Nairobi stock exchange, using a multiple regression model. A significant but positive correlation has been identified among the NSE 20 share index and MS through the study. In parallel to the above findings, Rjoub, Civcir, & Ressatoglu, (2017) identified a significant association between the prices of shares of the banking industry and the money supply using the fixed effect panel estimation method.

2.6.5 Interest Rate (IR)

The cost of borrowing or gain on lending is widely known as interest. Finan, (2017) referred interest rates as an adjustment factor of the value of money which erodes throughout a certain period. Thus, interest rates have been a key cause of savings and investments. Sufficient savings and investments are the key dimensions that drive an economy to grow (Mushtaq & Siddiqui, 2016).

Many theories were developed to explain the nature of interest rates and their influence on different aspects. Clark, (1899) developed a productivity theory of interest by considering the capital productivity. The theory explained that the interest arises parallel to the productivity of capital. In classical economics, interest is considered to be the reward for production factor – Capital. Being capital intensive causes increasing the level of interest paid out to the factor owners.

David Ricardo, Marshall, Cassels, A.C. Pigou, Taussing, Walras, and Knigh explained interest as a reward for the productivity of capital, which is identical to the marginal productivity of physical capital. Thus, it highlights that the interest rate is derived through the demand and supply of capital. Capital demand is also known as the demand for savings. Since the saved funds are being invested within the capital projects, investors pay interest in return, which creates a return on investment. It was highlighted that low-interest rates always motivate high investments, while high-interest rates create a demotivation of investments (Pal, 2018).

Rae, (1934) expounded his theory of interest while explaining the difference between the values of current income or consumption and future income or consumption. Bohm Bawerk and Irvin Fisher further developed this theory (Gootzeit, 1999). As per the "Agio Theory of Interest" introduced by Bohm Bawrek, there is a value addition on present consumption compared to future consumption. So, individuals always select current income over future income.

Similarly, individuals prefer to consume at present than in the future. So, there is a requirement of an inducement to change the time preference of current consumption to future consumption. Interest is paid as a reward for such sacrifice that consumers make.

Lately, Irvin Fisher modified this "Time Preference Theory of Interest" by stressing the loan supply, which mainly depends on people's personal preference to hold a certain amount of money at present than in the future. Due to time preference, the present goods are highly valued than future goods. Thus, individuals may leave their current consumption only on a considerable reward, which is the interest in the forgone sum of money. Thus, Fisher defined interest as a ratio between an individual's preference for a dollar of current income over a dollar of future income (Gootzeit, 1999).

Mutinda, (2012) stated that foreign direct investment, inflation, and GDP might be negatively impacted by the rising interest rates of a particular economy. Thus, it gives unnecessary pressure to business, which may demotivate the performance of the economy. This pressure may ultimately lead to a decrease in the output level of the country. Interest rate is considered a critical factor that investors pay much caution when they make short-term or long-term investments. Mainly because interest rates cause to fill the gap between the present value and the future value of the money invested, it affirms whether the investor could gain a higher or lower return than the amount invested.

Alam & Uddin, (2009) have researched the developing and developed countries using the monthly data and analysed the connection among the interest rates and

performance of the share market. Their findings revealed a significant negative association between share prices and interest rates among all the countries sampled in research. Thematic research was done by Rakhal, (2015) based on the Napoleon economy, also supported the above findings of the negative but significant influence of interest rates for the share market performance.

A Study based on the Nairobi Stock Exchange identified a negative association among prices of stocks and interest rates. Further, it emphasizes a prime relationship between those variables compared to other macroeconomic variables.

Maysami, Howe, & Hamzah, (2004) did a study based on the Singapore Stock Exchange, hypothesized that interest rates are negatively impacting the stock prices. Accordingly, the hypothesis has been developed using the behaviour of interest rates and share prices. A negative influence has been created towards corporate profits from increasing interest rates. Thus, the decline in profits further impacts on declining share prices. So, the investors are agreeable to pay for the stock with speculative benefits such as future dividends. It causes the companies to reduce their borrowings to finance for their inventories and non-current assets. This condition reduces the borrowing cost, which positively influences the firms' returns within the long run. When the investors purchase shares by using borrowed funds, the increase in interest rates causes them to make transactions costlier. It dissatisfies the investor who seeks a higher rate of return on their investments. Ultimately, the diminishing demand for shares causes to decrease in the prices of shares.

As per the findings of a study conducted 2005 – 2015, a substantial relationship among macroeconomic variables has been identified, including interest rates within the SAARC region (Mohammad, Islam, Alam, & Khan, 2017). Similarly, the findings of Aurangzeb, (2012), from 1997 – 2010 using three South Asian countries such as Sri Lanka, Pakistan, and India, also emphasized a negative but significant connection between stock exchange performance and interest rates.

Thishanthi & Silva, (2015) have analysed the impact of monetary policy for the period from 2005 – 2015 on CSE's performance and convinced that the treasury bill rate is

the highest significant monetary policy element that influences the ASPI of the country.

2.6.6 Gross Domestic Production (GDP)

GDP is a key indicator that emphasizes the performance of any economy. Thus, it is the real output level generated by any economy within a particular period. GDP measures the national income, output, and expenditure of the final values produced by a specific country within a particular period. As per, Chavda & Tarsariya, (2018), the market value of all the products manufactured by a particular country is GDP, which indicates whether the particular economy is in a recession, depression, or a boom.

It emphasizes how well the industry performed within that particular period. The continuous acceleration of GDP causes economic growth within the country while assuring less unemployment, environmental sustainability, and high living standards, which leads to motivating the investors and corporates to be more competitive and expand their business operations while making more profits (Raju & Manjunath, 2018).

As per Saymeh & Marwan, (2013), GDP growth reflects a country's capacity to increase goods and services. As Rahman, (2015) concluded, foreign direct investments have a high capacity to boom the GDP of Bangladesh's economy, which may increase the industry performance.

Based on the data in between 1990 – 2012 of Sri Lankan economy, Badullahewage, (2018) has found and inseparable influence between GDP and share market performance. It has highlighted that the share market fluctuations had been caused due to the unpredictable nature of the country's different macroeconomic variables.

Haque & Sarwar, (2012) have performed the same study based on the Karachchi Stock Exchange for the period of 1998 – 2009 using panel data analysis, which revealed a substantial and positive effect of GDP towards the individual returns of stocks. Nisa & Nishat, (2011) also resulted in the same Karachchi Stock Exchange findings between 1995 and 2006. According to the panel data collected for seven listed cement

companies in Bangladesh, it has identified that there is an instrumental impact from GDP towards share prices.

Chavda & Tarsariya, (2018) has emphasized a significant but positive connection among GDP and share market index. From 2008 – 2017, they have considered 30 companies listed on the Bombay Stock Exchange to conclude the result above. The findings of the research done by Paramati & Gupta, (2011) based on the Indian economy from 1997 – 2009 also supported the same findings through regression analysis.

Apart from the Asian culture, it has identified a significant but positive impact from GDP towards stock prices through research done based on the United Arab Emirates from 1990 to 2005, using 17 companies listed in their stock exchange (Al-Tamimi, Alwan, & Rahman, 2011).

Similarly, a study based on Nigeria also identified the Nigerian stock exchange's high responsiveness to real output changes (Maku & Atanda, 2010). The analysis done by using the information from the Namibian Stock Market has identified a positive connection between economic activities and stock prices (Eita, 2012).

Thus, a study was done from 1990 – 2009 by using the Amman Stock Exchange Index identified that the dimensions of investment have a positive impact on the stock exchange, which has considered a more massive effect than the significant positive impact that GDP has with the same stock exchange (Abedalfattah & Duraid, 2012).

2.6.7 Foreign Exchange Rate (FER)

Foreign exchange rates are highly dependent on the demand and supply of foreign currencies within the economy. High capital inflows cause to appreciate the domestic currency, which enhances the balance of payment.

"Traditional approach" or "the trade or elasticities approach" determines the exchange rates based on the flow of goods and services. The equilibrium exchange rate will be determined by using the balance between imports and exports. Further, the local currency depreciation also impacts the deficit in the trading account or higher import

balances. However, the local currency unit's depreciation motivates exports by increasing exporters' income at a higher rate. This condition ultimately leads to an increment of the corporate profits, which results in increasing stock prices in the short run. Solnik, (1987) convinced that the real currency appreciation demotivates the export competitiveness while the real currency depreciation enhances exports in the short run.

Dornbusch & Fischer, (1980) have developed a model to determine exchange rates based on asset prices. Accordingly, when the stock prices increase, it will attract more foreign currency inflows to the country. Vice-versa, the decrease in stock prices causes to deteriorate the shareholders' wealth, which ultimately declines the country's wealth. Thereby, it leads to a decline in the domestic currency demand, which leads the monetary authorities to decrease interest rates. Lower interest rates cause the country's capital to flow, which depreciates the domestic currency against foreign currencies. Thus, lower stock market prices may cause to depreciate the domestic currency.

Within the Asian region, research done based on the Indian economy by using economic data from 1997 – 2011, has found a substantial correlation among the indices of share market such as market capitalization, Sensex and market turnover, and inflation, interest rate, and exchange rates. Based on the Auto Regressive Conditional Heteroscedastic (ARCH) model & Granger causality, it has emphasized unidirectional causality between the real economy and the stock market (Tripathi & Seth, 2014). Similarly, research based on the Pakistan economy has used a sample period 1994 – 2007, and May-1998 has been used as a structural break, which is when Pakistan conducted the nuclear test. As per findings, the nominal exchange rate and the KSE-100 Price Index are negatively correlated during the pre-break period; however, both variables show a positive correlation during the post-break season (Rashid, 2008).

Singapore based research studied the responsiveness of the stock market against the exchange rate. The findings revealed a positive association among both the variables. Further, the research emphasized a significant impact on the performance of the finance sector through exchange rates. However, a significant negative correlation has

been identified among exchange rates and hotel sector returns (Maysami, Howe, & Hamzah, 2004).

A study was done by Megaravalli & Sampagnaro, (2018) by using monthly time series data from 2008-2016 for Indian, Chinese, and Japanese economic systems. A significant but positive long-run effect has been identified among the performance of stock exchange and variables. In contrast with the above findings, Nepal based research revealed that exchange rates are negatively affecting the stock market performance (Rakhal, 2015).

Research done using SAARC countries has identified significant influence from the variables such as foreign currency reserves, the exchange, and interest rates when determining share prices. Further, the findings have emphasized a positive and moderate correlation among exchange rates and share price indices (Mohammad, Islam, Alam, & Khan, 2017).

SAARC countries and China-based research conducted using OLS have compared the results by dividing them into two groups: Bangladesh, Pakistan, and India as the first group and India and China as the second group. The findings of the first group revealed a significant positive impact of share returns on exchange rates. However, within the first group, Pakistan convinced a significant but negative association among share market returns and exchange rates. Sri Lanka convinced a positive but significant association among share prices and exchange rates. Further, the second group's findings, including China and India, revealed a significant negative association between share prices and exchange rates (Kabeer, 2017).

The Japanese stock market-based research findings using VECM have identified a positive correlation between the exchange rate of the US dollar & Japan Yen and the Tokyo stock exchange indices (Mukherjee & Naka, 1995). The Malaysian stock exchange performance has been analysed using the Vector Autoregressive model (VAR), and the findings emphasized that the depreciation of the Malaysian Ringgit effects to upsurge the stock market return (Rahman, Sidek, & Tafri, 2009).

When analysing the findings of Non-Asian economies, Kenyan based research has found a negative relationship among the exchange rates between the Kenyan shilling and both Euro and Dollars and Nairobi stock market indices through regression analysis (Kitati, Zablon, & Maithya, 2015).

The analysis was done by using the GARCH model on a sample period of 1999 – 2012, revealed that exchange rates are negatively affecting the performance of the stock exchange (Hsing, Phillips, & Phillips, 2013). Further, the Namibian stock exchange-based research results revealed that exchange rates might create an equilibrium in stock market prices (Eita, 2012). Okoro, (2017) has tested the APT using the performance of the Nigerian share market and macroeconomic variables. The findings revealed that there is no connection between the Nigerian share market performance and macroeconomic variables. Other Nigerian-based research also revealed similar stock exchange (Asaolu & Ogunmuyiwa, 2010; Onakoya, 2013; Inyiama & Nwoha, 2014).

2.7 The Research Gap

Sharpe, (1964) addressed the absence of microeconomic theory to predict the capital market behaviour. He developed the investor preference function by considering the expected value of the capital asset and standard deviation. He introduced CAPM for the valuation of investment assets while focusing on the risk-free market rate, risk premium, and total return. This approach focuses on the company's internal factors, which determines the asset's risk premium.

However, in EMH, it highlighted that the price of the assets traded in the capital market has a considerable capacity to depict its overall performance. Thus, EMH also confirmed that external environmental factors influence asset prices (Fama, 1970).

Later Ross, (1976) addressed the importance of considering both systematic and unsystematic risk in valuing the capital market assets. Further, the same study highlighted that the macroeconomic environment changes possibly influence to determine the prices of the investment assets traded in the capital market.

This finding was later directed towards new research to identify macroeconomic variables' real effect on share market performance.

Based on APT's conclusion, Fama & Schwert, (1977) have studied investment assets' behaviour in parallel to the variations of expected and unexpected inflation rates in the United States. The findings revealed that the common stock returns are negatively related to the expected inflation and unexpected inflation.

Grossman & Shiller, (1981) studies the determinants of massive and unpredictable swings of the price indices in capital markets. The study has focused on the "new information" and its influence on the current and future economic activity. The research was conducted by using the stock price movement of a century. It revealed that the real interest rates' movements have a considerable influence in creating volatility in stock market indices.

The Fisherian theory of interest explains that the real interest and real risk premium and expected inflation rate determine any investment asset's nominal expected return. A study was done by Geske & Roll, (1983) revealed that the stock exchanges are negatively related to the changes in the expected inflation. Mandelker & Tandon, (1985) also confirmed a negative relationship between inflation and real stock returns based on the United States economy for 1966-1976.

Mukherjee & Naka, (1995) studied the impact of six macroeconomic variables on the Japanese stock market and revealed a cointegrating relationship between exchange rate, inflation rate, money supply, industrial production, long-term government bond rate, call money rate, and stock prices.

Researches have been carried out to recognise the stock exchange level parallel to the shocks that occur within the macroeconomic environment. These researches have been tested with many macroeconomic variables in different economic concepts (Tripathi & Seth, 2014; Mohammad, Islam, Alam, & Khan, 2017; Nisa & Nishat, 2011). Aigbovo & Izekor, (2015) stated that many researches confirmed a link between macroeconomic variables and the stock market within the developed countries based on the APT.

Kumar, (2013) has conducted a factor analysis to identify the Indian stock market's performance parallel to the changes that occur among macroeconomic variables. The research has used gold prices, repo-rate, MS, inflation, oil prices, foreign direct investments, foreign exchange reserves, call money rate, foreign institutional investment, foreign exchange rates, the balance of trade, and industrial growth rate as macroeconomic variables. Accordingly, the Indian stock exchange performance was forecasted using a factor model that identified the macro environment, industrial performance, and policy rates as factors. The R-squared of the developed model was 93.2%.

Kitati, Zablon & Maithya, (2015) used both multi-variate and simple regression methods to study the Nairobi Securities Exchange's behaviour parallel to the changes in inflation, foreign exchange rate, and interest rate. As per their findings, all the variables are negatively impacting the performance of securities exchange.

Maysami, Howe & Hamzah, (2004) studied the Singapore stock exchange indices and macroeconomic factors based on the co-integration approach. The findings revealed a cointegrating relationship between industrial production, exchange, interest rates, price level, money supply, and Singapore stock market indices.

Mohammad, Islam, Alam & Khan, (2017) analysed the stock markets in the SAARC region to identify their performance parallel to the changes that occur among macroeconomic variables. Accordingly, they have developed a multiple regression model and revealed a significant association among the share market and foreign currency reserve, exchange, and interest rates. The findings revealed that inflation, money, and stock exchange performance do not maintain any significant association.

Megaravalli & Sampagnaro, (2018) conducted a similar study using three Asian countries, Japan, India, and China, and stock exchange and macroeconomic factors. The research used econometric analysis and pooled mean approach to reach the findings. The identified long-run effect was positively significant among the performance of stock markets and exchange rates. Further, it revealed a negative insignificant long-run effect from inflation towards the performance of stock markets.

However, the short-run analysis confirmed no significant association among the performance of stock markets and macroeconomic variables.

Rashid, (2008) has conducted a study with the period break for Pakistan's economy to analyse stock exchange performance parallel to the changes that occur within macroeconomic variables before and after the nuclear test conducted by Pakistan in 1998. The study has extended towards the macroeconomic variables such as interest and exchange rate, consumer prices, and GDP. As per findings, there is bidirectional long-run causation among share prices and all aforesaid economic variables.

Nisa & Nishat, (2011) have conducted the same study based on the Pakistan economy. As per findings, the previous behaviour 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.

Angko, (2013) studies the determinants of Ghanaian stock market volatility using econometric models, and the findings revealed that economic growth is the critical determinant in determining both short and long run the performance of the share market.

Dissanayake and Biyiri, (2017) convinced that many internal dynamics of a listed company, such as dividend per share, earnings per share, and return on equity, may impact stock prices. However, as per prior findings, both the internal and external factors have been impacted to determine stock prices (Subing, Kusumah & Gusni, 2017). The internal factors that have been considered are mostly firm-specific factors such as systematic risk, return on assets, and the price-earnings ratio. In contrast, the external factors that have been considered are macroeconomic variables such as inflation, oil prices, economic growth, the supply of money, the risk-free rate of interest, and gold prices. Research has been done by using the data from the 2008 – 2015 period. According to the above research findings, stock prices are being impacted significantly by internal and external factors. Further, they have recommended future research to develop their models by identifying further factors or applying them to different economies.

When attracting investors to the country, a given country's macroeconomic environment's performance has become a critical variable. A study done using listed Polish companies, Bialowolski & Weziak-Bialowolska, (2013), has identified a positive association between macroeconomic factors and legal-environmental factors and investment decisions.

Within the Sri Lankan context, Nijam, Ismail, & Musthafa, (2015) has conducted a study over the period from 1980 to 2012 by considering five macroeconomic variables. Accordingly, they have measured CSE's performance using ASPI while considering gross domestic production, interest rate, the balance of payment, inflation rate based on wholesale price index, and exchange rate as endogenous variables. They have developed the OLS regression model and revealed a significant relationship between the macroeconomic variables and CSE's performance. Further, the study stated a significant positive association between GDP, IR and FER, and inflation rate. However, they revealed an insignificant relationship between the balance of payment and CSE's performance.

The econometric analysis was conducted using the Sri Lankan macroeconomic annual data from January 1986 to December 2014. The study considered inflation rate, money supply, exchange rate, average weighted prime lending rate, and ASPI. The findings revealed a significant long-run and short-run effects in determining the stock market indices. Further, the average weighted prime lending rate and exchange rate confirms a positive relationship with ASPI. However, the money supply and inflation rate showed a negative relationship (Francis & Ganeshamoorthy, 2015). This study's findings are mostly similar to Nijam, Ismail, & Musthafa, (2015); however, the inflation rate findings provide a conflicting result.

A research was conducted for the period from January 1985 to December 2004 to analyse CSE's performance in parallel to the macroeconomic environment changes in Sri Lanka. The study focused on six macroeconomic variables: GDP, interest rate, inflation rate, money supply, exchange rate, and the United States share price index. The research revealed a causal relationship between ASPI and interest rate, the United States share price index, and GDP. Further, it revealed a bi-directional causal

relationship from ASPI to the inflation rate, ASPI to the money supply, and ASPI to the exchange rate. The findings of this study deviate from Francis & Ganeshamoorthy, (2015) concerning money supply, inflation rate; thus, it complies with the findings of Nijam, Ismail, & Musthafa, (2015) (Wickremasinghe, 2006).

Menike, (2006) studied the effect of macroeconomic variables on stock prices of CSE for the period from September 1991 to December 2002 using 242 stocks listed in CSE. Monthly data was collected about money supply, inflation rate, interest rate, and exchange rate for the sampled period and developed a multiple regression model in the study. The findings revealed a positive relationship between money supply and one lagged inflation rate and stock returns. In contrast, the exchange rate and risk-free interest rate is negatively related to the stock returns. Thus, this study's findings challenged Francis & Ganeshamoorthy, (2015); Nijam, Ismail, & Musthafa, (2015).

Badullahewage, (2018) has also conducted the same study for the period from 1990 – 2012 within Sri Lankan context by using inflation, gross domestic product, interest rates, and exchange rates as macroeconomic variable and measured their influence CSE. The study developed a log-log regression model and revealed a strong connection between the considered macroeconomic variables and CSE. Thus, it revealed a positive relationship between interest rate, exchange rate, GDP, and ASPI, while the inflation rate shows a negative relationship with ASPI. Further, the study confirms the importance of maintaining a low inflation rate to achieve a better CSE performance. The findings relate to the inflation rate and exchange rate of this study conflicts with Menike, (2006). However, the results of the inflation rate and ASPI of this study confirms the negative relationship developed by Francis & Ganeshamoorthy, (2015).

Perera, (2015) conducted a study by using annual interest rate, exchange rate, inflation rate, and money supply data for 13 years (1999 – 2012) and derived an OLS regression model from identifying the relationship between the considered macroeconomic variables and ASPI in Sri Lanka. The findings of this study revealed that only money supply is positively significant in determining ASPI. However, the exchange rate, inflation rate, and interest rate are insignificant in determining CSE's performance.

Further, based on the P-value of F-statistic, the study revealed that these variables are collectively significant in determining ASPI. However, the findings of this study showed a conflicting result from Francis & Ganeshamoorthy, (2015); Nijam, Ismail, & Musthafa, (2015); Badullahewage, (2018). Though this study's findings relate to the money supply, a CSE performance is complying with Menike, (2006), the other variables show a conflicting result.

Fernando, (2018) has conducted an econometric analysis by considering interest rate, inflation, money supply, and exchange rate as selected macroeconomic variables. The study analysed the impact of those variables on stock market volatility and stock market returns from 1998 to 2016. The research findings revealed a long-run relationship between macroeconomic variables and stock returns. Thus, it highlighted a long-run negative relationship between treasury bill rate, exchange rate, and stock returns. But a significant positive relationship between money supply, inflation rate, and stock returns. The study also revealed that the interest rate and money supply revealed a macroeconomic risk to stock market returns volatility in Sri Lanka. The findings of this study show considerably different results than the previous studies Perera, (2015); Menike, (2006); Perera, (2015).

Kengatharan & Ford, (2019) has conducted a study using recent data for five years from 2013-2017 and analysed the performance of 72 selected listed companies from CSE. The findings revealed that GDP does not significantly impact determining share price volatility among the selected companies. However, the exchange rate has a significant negative influence on share price volatility within Sri Lanka.

When analysing the behaviour of macroeconomic variables, GDP growth shows more heteroscedastic volatility from 1970 to 2016. Thus, it was managed to sustain approximately 5% growth for the last few decades. However, the GDP's structural composition shows a significant shift in the service sector during the previous decades. Simultaneously, the inflation rate and interest rate also shows more heteroscedastic behaviour from 1978-2017. Thus, the rupee depreciation has been sped up within the last decade (Weerakoon, Kumar, & Dime, 2019).

When analysing the current macroeconomic variables within Sri Lanka, since 2002, there have been many Sri Lankan economic system changes, such as hybrid states, ceasing the civil war, and post-war government (Samarasinghe, 2003). Furthermore, investors' attraction to the economy has been highlighted as a critical element in fulfilling the investment and savings gap within Sri Lanka (Weerakoon, Kumar, & Dime, 2019).

CSE is the key financial market that generates capital inflows to the Sri Lankan economy. The prior studies conducted to analyse CSE's performance respective to the changes that occur within the macroeconomic environment show conflicting results. They could not be applied in general to the overall period. Thus, it is timely to research to analyse CSE's recent performance in parallel to the changes that occur within the macroeconomic environment in Sri Lanka.

CHAPTER 03

METHODOLOGY

3.1 Introduction to the Chapter

The rationale discussion of literature within the second chapter developed an excellent base to continue the study. Accordingly, it has recognised the related factors that impact the performance of the stock exchange. A proper framework will be designed in this chapter to achieve the objectives of the research. Thus, it will elaborate on the methodologies used to analyse the data in this research. The developed theoretical model will be used to identify the dominant macroeconomic variables affecting the CSE.

This chapter develops a conceptual framework that consists of the theoretical framework and research philosophy, including the conceptual framework, hypotheses, research methodology, and the research approach. Further, the discussion will lead to research methods and research design techniques, sample selection, sources of data, and data collection methods. Finally, the statistical methods used for the analysis will be introduced.

3.2 Theoretical Framework

The relationship between factors affecting the stock market performance has already been identified through the literature survey. The theoretical framework has been developed based on those identified relationships within the literature.

Quantitative researches should be followed by a conceptual framework that has been derived through the theoretical framework. Further, the framework should explain how the theoretical concepts or relationships will be analysed through the study (Veal, 2005).

The study focuses on the positivistic research approach, which is convinced through the theoretical framework or the theories. Thus, the conceptual framework can derive

the hypothesis and analyse and interpret the data meaningfully (Hussey & Hussey, 1997).

This chapter's theoretical framework focuses on identifying the most significant macroeconomic factors that affect CSE's performance.

Development of Theoretical Framework

Many prior studies were conducted to detect the connection among the stock exchange's performance parallel to the changes that occur within the macroeconomic environment within different economic contexts. Accordingly, it is possible to summarize the identified relationships as follows;

Table 3.2: Summary of Literature Review

Variable	**Relationship**	**Identified By**
Inflation Rate (CCPI)	Negative	Megaravalli & Sampagnaro, (2018)
Gold Prices (GP)	Negative	Long, Duy & Dang, (2017)
Crude Oil Prices (OP)	Positive	Tripathi & Seth, (2014)
Money Supply (MS)	Positive/Negative	Nisa & Nishat, (2011); Tripathi & Seth, (2014)
Interest Rate (IR)	Negative	Rakhal, (2015); Alam and Uddin, (2009)
Gross Domestic Production (GDP)	Positive	Abedalfattah & Duraid, (2012); Haque & Sarwar, (2012)
Foreign Exchange Rate (FER)	Positive/Negative	Rashid, 2008; Maysami, Howe & Hamzah, 2004

3.3 Conceptual Framework

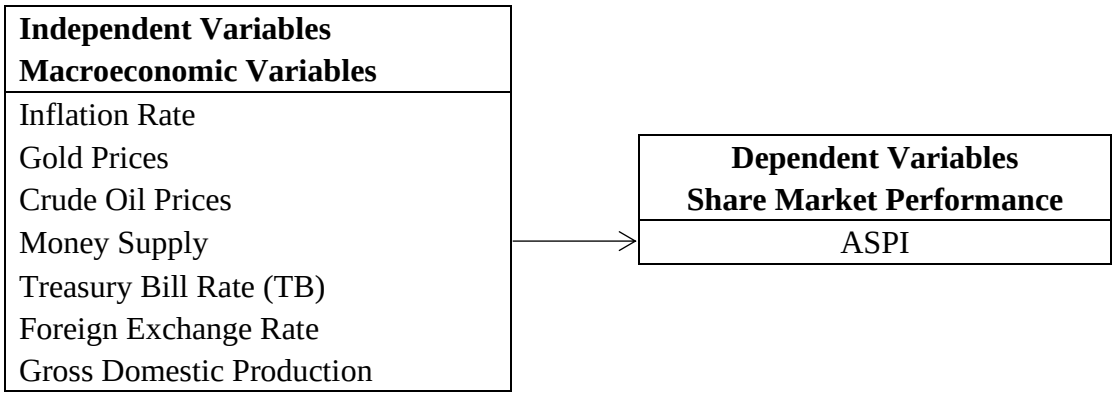


Figure 3.2: Conceptual Framework

The literature review developed in chapter two critically examined the theories and concepts and developed a proper understanding of the association among macroeconomic variables and stock exchange performance. Accordingly, the current study aims to identify the common macroeconomic variables impacting the share market performance, and the findings will be compared with the prior empirical results.

3.4 Introduction to Research Hypothesis

The current study focuses on addressing on below research hypothesis;

Hypothesis I

H_0: There is no significant impact from the considered macroeconomic variables individually on the performance of CSE

H_1: There is a significant impact from the considered macroeconomic variables individually on the performance of CSE

Hypothesis II

H_0: There is no significant impact from the considered macroeconomic variables collectively on the performance of CSE

H_1: There is a significant impact from the considered macroeconomic variables collectively on the performance of CSE

Previous literature confirmed that the macroeconomic factors such as; general price level, gold prices, money supply, crude oil prices, interest rates, gross domestic production, and foreign currency exchange rate have considerably impacted market performance.

The above factors will be considered in the current study and analysed to address the developed research hypotheses.

3.5 Population and Sample Size

Population means the overall observations of a given data set from which a subset is drawn (Ostle, 1963). This study's population includes the monthly economic and share market indicators from 1950 to date, published by the CBSL and CSE, respectively.

The sample period from January 2002 – September 2019 has been considered for the study, and monthly data has been collected to continue this study. Since both economic booms and recessions have occurred during this period, it shows better macroeconomic variables performance. Further, all the listed companies in the CSE in Sri Lanka have been considered to collect their overall performance monthly.

3.6 Data Source and Data Collection Method

The key performance indicator used in this study is the ASPI of all 22 sectors, which represent the entire market performance of CSE. The required data were collected by using secondary sources. Accordingly, various sources have been used, such as Securities & Exchange Commission's (SEC), annual reports published by CBSL, brokering companies, journals, previous articles, magazines, and referred books from the library.

Even though there is a wide range of factors considered based on historical literature, it has often been used in secondary documentary data.

3.7 Data and Instrumentation

Monthly data of the considered variables were collected, covering the period from January 2002 to September 2019.

The defined variables were measured by using the macroeconomic indicators that has been widely used in the prior literature. Simultaneously, the performance of CSE which is the dependent variable of the study has been measured by using ASPI, which is the price index published by CSE daily, monthly and annually.

Table 3.3: Operationalization of the Dependent Variables

Variable	Measurement	Data Source
Inflation Rate	Colombo Consumer Price Index	Monthly reports published by the CBSL
Gold Prices	Gold prices per Troy oz. in Sri Lankan Rupees (LKR) for the last day of the month	Monthly reports published by the CBSL
Crude Oil Prices	Price per Crude Oil Barrel in LKR	www.indexmundi.com
Money Supply	Money Supply (M4)	Monthly reports published by the CBSL
Interest Rate (Treasury Bill Rate)	Treasury Bill Rate	Monthly reports published by the CBSL
Foreign Exchange Rate	US Dollar to Sri Lankan Rupee Exchange	Monthly reports published by the CBSL
Gross Domestic Production	Gross Domestic Production in Sri Lankan Rupees Millions	Quarterly data published by the CBSL and interpolated to monthly data.

Duly collected data will be analysed using different statistical software such as E-views 9 and SPSS Statistics 23.

3.8 Methods of Analysis

3.8.1 Jarque-Bera

This is a non-negative figure which measures the goodness-of-fit of a given data set. If the calculated statistic is away from zero, then it is assumed that a non-normal distribution among the given data set. The below hypothesis has been used to conclude the data series' normality with a significant level of 0.01 or 0.05.

H_0 = Normal distribution of given data (P value > 0.05)

H_1 = Non-normal distribution of given data

3.8.2 Unit Root Test

If the data collected for analysis has the sequential time-varying character, then those data's stationarity should be confirmed. The nature of data considered to develop the model has a high impact on the model's effectiveness. Having a constant mean and

variance for a particular data set is necessary to assure stationarity. Moreover, the data span among two consecutive periods denominates the considered data's covariance within that stipulated time. Accordingly, the lag length is assumed to be the key determinant of the correlation among a given data set and their respective lagged values. Thus, the ability of a given time-series data set to maintain a strong correlation among the lagged values can be identified as the stationarity of a given time series.

So, as an initial stage, the stationarity of the data should be tested. If the data follows the non-stationary character, using such data to develop a model may provide a spurious output. The reason for that is the ability to have a high R^2 due to the usage of two variables, which develops in a sequential pattern, which is completely unrelated. Accordingly, a model that is developed by using non-stationary data is less reliable.

The stationarity of the data will be tested to obtain a useful model by using;

01. Phillips – Perron Test (PP Test)
02. Augmented Dickey-Fuller Test (ADF Test)

ADF Test

It assumes that the residuals of a given time-series are uncorrelated, and the data follows the AR(p) process. Accordingly, two hypotheses have been used in the ADF test as follows.

H_0 = Time series data is non – stationarity

H_1 = Time Series data is stationarity

The test will be carried out in level (I (0)) and 1^{st} difference (I (1)) for all the observed variables.

Phiillips – Perron Test (PP Test)

The PP test integrates an automatic correction for the Dickey-Fuller (DF) method by constructing a correction to the coefficient, allowing for autocorrelated residual. This is a nonparametric correction to DF.

Accordingly, parametric errors do not affect for PP test. Thus, the residuals are heterogeneously distributed and weakly dependent. Therefore, PP values also test the data set's stationarity by considering the intercept and trend terms of the variables. The test will be carried out in level (I (0)) and 1^{st} difference (I (1)) for all the observed variables.

PP test uses two hypotheses as follows.

H_0 = Time series data is non – stationarity

H_1 = Time Series data is stationarity

However, if unit-roots exist within a given data set, it provides a hint of a possible long-term association among the observations.

The time-series data will be analysed using Factor Analysis (FA) method, and below tests were carried out to assure the appropriateness of data for FA.

01. Correlation matrix of the observed variables
02. Bartlett Test
03. Kaiser-Meyer-Olkin Test (KMO)
04. Normality test for variables

3.8.3 Correlation matrix

the statistical relationship among two series of data will be measured by using Correlation. Accordingly, the correlation coefficient may vary between +1 to -1, which interprets the nature of the given data series. If the coefficient is close to +/- 1, it is supposed to be a healthy relationship, while if it is close to 0, it'll be a weak relationship. A significant correlation among the x and y variables is a key determinant for effective factor analysis.

Factor Analysis or Principle Components are the widely used multivariate tools in economic forecasting (Forni, Hallin, Lippi, & Reichlin, 2000; Lütkepoh, 2010)

3.8.4 Bartlett Test

This measures the availability of equal variances among *k* samples. Accordingly, the Bartlett test assures the homogeneity of variances.

The log weighted average variance of a given data point will be compared with the log variances' weighted total to calculate the statistic.

The hypothesis developed to test the homogeneity of variances can be explained as follows.

H_0: $\sigma_1^2 = \sigma_2^2 = \ldots. = \sigma_k^2$

H1: $\sigma_i^2 \neq \sigma_j^2$ for one pair (i,j)

The test statistic;

$$T = \frac{(N-k)\ln S_p^2 - \Sigma_{i=1}^{k}(N_i - 1) ln\, S_i^2}{1 + \left(\frac{1}{3(k-1)}\right)\left(\left(\frac{\Sigma_{i=1}^{k}}{N_i - 1}\right) - \frac{1}{N-k}\right)}$$

S_i^2 = i[th] group variance

N_i = i[th] group sample size

N = Total sample size

k = Number of groups

S_p^2 = Pooled variance

The test significance level is considered to be α, and it can be concluded that the variances are not equal if;

$$T > X_{1-\alpha,k-1}^2$$

With the significance level of α and (k-1) of degrees of freedom, the chi-square critical value has been calculated by $X_{1-\alpha,k-1}^2$.

Accordingly, the presence of unequal variances should be confirmed by rejecting H_0 to satisfy FA's data.

3.8.5 Kaiser-Meyer-Olkin (KMO) Statistic

Since the current study develops common independent factors based on factor analysis, it is required to identify the observed data's suitability to continue the process. Further, the adequacy of the sample size should be determined before proceeding with the study. Thus, the KMO test statistic can be used to fulfil the above requirements, which measure variance among the variables. Accordingly, the KMO returns a value between 0 -1. As a thumb rule, the calculated statistic should be higher than 0.6 to conclude that the sampling is adequate to continue with factor analysis.

The formula for KMO statistic calculation is as follows.

$$MO_j = \frac{\Sigma_{i \neq j} r_{ij}^2}{\Sigma_{i \neq j} r_{ij}^2 + \Sigma_{i \neq j} u}$$

Where;

U = [u_{ij}] is the partial covariance matrix

R = [r_{ij}] is the correlation matrix and

3.8.6 Factor Analysis (FA)

This study's independent variables are the macroeconomic data, which has a considerable correlation between them. So, FA has been used to analyse the data, explaining the variability among the identified correlated variables by combining them into a common factor.

There are two types of FA, as in Exploratory FA and Confirmatory FA. The exploratory FA has been used in this research due to the difficulty of determining the number of factors in advance.

FA assumes that there is m (<p) underlying common factors (F_i i=1,2, 3,..m) when p of response variables has been observed.

Accordingly, the FA model for "m" factors is written as:

$X_i = \mu_i + \lambda_{i1}F_1 + \lambda_{i2}F_2 + \lambda_{i3}F_3 \ldots + \lambda_{im}F_m + \eta_i$ (i = 1,2,3, ..,p)

λ_{ij} = Factor loading of the j[th] factor and i[th] response variable

η_i = The unique factors for a given X_i.

Accordingly, it can be assumed that μ_i = 0 for all I without losing the generality.

When analysing the data using FA, it is good to carry out the standardized data, and the following assumption is being made relates to the data.

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

As per the assumptions, the following variance and correlation conditions are true for the two-factor model.

$V(X_j) = 1 = \lambda_{j1}^2 + \lambda_{j2}^2 + \psi_j^2$ where $V(\eta_j) = \psi_j^2$

Corr $(X_j, F_1) = \lambda_{j1}$, Corr $(X_j, F_2) = \lambda_{j2}$ and Corr $((X_i, X_j) = \lambda_{i1}\lambda_{j1} + \lambda_{i2}\lambda_{j2}$

Extraction and Identification of Factors

It is essential to identify the number of common factors (m). Such identified factors are the derivations based on the highly correlated variables considered in the analysis, to proceed with FA.

Accordingly, the extraction of factors can be done by using different extraction methods such as Principal Axis Factoring (PAF), Maximum Likelihood Factoring (MLF), and Principal Component Factoring (PCF)

Out of which, PCF has been considered in the current study to extract factors. There are few assumptions used in PCF, as in prior estimates are not compulsory to determine the communalities and the communalities of the considered observations are equal to one.

Only a few principal components with the eigenvalues greater than one will be considered for the extraction. Further, the scree plot can indicate the number of common factors with $\lambda_1 > \lambda_2 > \ldots \lambda_{p,}$ where the "elbow" shape helps to finalize the number of factors accordingly.

Thus, the principal components are considered factors, while the remaining principal components are regarded as nuisance components. PCF is the most common and standard extraction method, which is widely used in FA.

Rotating Factors

Factor rotation causes to minimize the complexity of the factor loadings to make the structure more straightforward and meaningful to interpret. The rotation procedures try to make factor loadings close to zero and other factor loadings to be large. Thus, factor rotation simplifies the loading-matrix in Principal Component Analysis (PCA).

The factor rotation can be done by using two methods as in oblique rotation and orthogonal rotation. Orthogonal rotation is the commonly used method that rotates variables using the Varimax, the Quartimax, and the Equimax methods.

Thus, in the current studies, the extracted factors will be rotated using orthogonal rotation to identify the most suitable combination.

Factor Score Coefficients

A common factor's linear function will be derived using the factor score coefficients of the observed variables. Accordingly, multiple linear regression is one of the methods used to estimate factor score coefficients in SPSS.

Accordingly, $\widehat{F_i}$ be the estimated factor score for the i^{th} factor then,

$$\widehat{F_i} = \widehat{\beta_1}\, x_{i1} + \widehat{\beta_2}\, x_{i2} + \cdots + \widehat{\beta_p}\, x_{ip}\ (i = 1,2 \ldots m)$$

Thus, β_i's are the coefficients of linear combinations to predict the selected factors' values, known as factor coefficients.

3.8.7 Johansen Co-Integration Test

The substance of continuous association between ASPI and the common factors will be measured through this test. Once the time series data is confirmed as a stationary distribution, the co-integration between the considered factors should be measured. The Johansen co-integration test can be conducted to assure the long-lasting equilibrium among the variables using both trace and maximum-eigenvalue methods

The trace test hypotheses are,

H_0: The number of co-integration vectors is $r = r^* < k$

H_1: $r = k$

The maximum-eigenvalue test hypotheses are,

H_0: $r = r^* < k$

H_1: $r = r^* + 1$

A long-term equilibrium among the observations can be confirmed by rejecting the null hypothesis. If such is confirmed, then the Vector Error Correction Model (VECM) can be developed. Otherwise, Vector Auto-Regression Model (VAR) can be designed to ensure the long-run effect short-run effect, respectively.

3.8.8 Vector Auto-Regression Model (VAR)

This model was developed to identify the interdependencies among the different time series data within a stochastic process. Accordingly, the VAR model is created by generalizing the univariate autoregressive model, allowing many estimated analysis

variables. The VAR model variables explain its evolution by using the lagged values of its' own, other variables, and the error term.

Accordingly, the VAR model explains the evolution of variables throughout a specified period (t = 1, 2, …T), and the model will be developed as a linear function. The data has been collected as a *K* vector for $Y_{t,}$ which includes the i^{th} element (Y^{it}), the given data point in 't' time of the i^{th} variable.

So, the VAR model can be defined as;

$$y_t = c + A_{1yt-1} + A_{2yt-2} + \cdots + A_{pyt-p} + e_t$$

The P^{th} order VAR model is also known as VAR with p lags. Accordingly, the optimum lag length has been decided by using the Schwarz Information Criterion (SIC) and Akaike Information Criterion (AIC)

3.8.9 Wald Test

This measures the significance of the explanatory variables in a defined model. So, it measures the ability of independent variables to interpret the dependent variable collectively.

The hypothesis will be developed to measure the magnitude of collective lagged coefficients of the VAR Model. Accordingly, less significant variables will be removed from the model to enhance the model further.

The Wald test test-parameter can be defined as;

$$W = \frac{(\hat{\theta} - \theta_0)^2}{var(\hat{\theta})}$$

The hypothesis is defined as;

H_0: $c(\theta) = 0$

H_1: $c(\theta) \neq 0$

If the H_0 is rejected with 5%-10% (0.05 – 0.1) of significance level, then it is possible to eliminate such variables to enhance the model further.

3.8.10 Granger Causality Test

The usefulness of a given time series data to forecast another is measured by using a statistical hypothesis test, which is known as the Granger causality test. As per Granger, (1969), if x_i "Granger causes" 'y_i' then the past values of x_i should be useful to predict y_i, and its mathematical formulation is relying on linear regression modelling.

When proceeding with the Granger causality test developed based on the linear regression model's scope, it assumed that the considered data fulfils the stationarity character.

The test will run using the lagged coefficients of the VAR model. If such considered lagged coefficients are individually (t-test) or jointly (f-test) significant, with 5% - 10% of significant level, such variables add an exploratory power to the model, leading to rejecting H_0.

Thus, the hypothesis developed to test the Granger causality is as follows.

H_0 = No Granger cause between the considered dependent and independent variables

H_1 = Granger cause exist among the considered dependent and independent variables

3.8.11 Test of Heteroscedasticity

When analysing the time-series observations, the time-varying volatility or "heteroscedasticity" is the most common feature of such series. Engle, (1982) considered the past shocks of time series data and addressed the conditional variance of those data points in a model which is known as the ARCH model.

In the current research, the LM test has been used to identify such an ARCH effect or the "Heteroscedasticity" nature.

The hypothesis has been developed for the test as follows;

H_0 = The time-series data follow a homoscedastic process Var $(\varepsilon_i) = \sigma^2$

H_1 = The time-series data follow a heteroscedastic process Var $(\varepsilon_i) = \sigma_i^2$

With the ARCH effect's confirmation, the Auto Correlation Function (ACF) and Partial Auto Correlation Function (PACF) of the squared residuals will be plotted to identify the correlation between the LN_ASPI_1 and LN_ASPI_{t-1}.

3.8.12 Generalized Autoregressive Conditional Heteroscedasticity (GARCH) Model

There is high volatility within the variables of the financial markets. The GARCH model is developed as a statistical tool to measure financial markets' volatility by forecasting conditional variances. Accordingly, the extrinsic variable's historical values and any other considered intrinsic variables or exogenous variables have been used to measure the extrinsic variable's variance.

The GARCH (1,1) model can be explained as;

$$\mu_t = \sigma_t \in_t \qquad \in_t \sim IID(0,1)$$

$$\sigma_t^2 = \omega + \alpha\mu_{t-1}^2 + \beta\sigma_{t-1}^2$$

3.8.13 Tests for Residuals

A time series model may consist of residuals or error terms after fitting a model. The actual data points and the corresponding fitted values will be compared to identify a given model's residuals.

$$e_t = y_t - \hat{y}_{t.}$$

y_t = Actual data point of the dependent variable

$\hat{y}_{t.}$ = Corresponding fitted value forecasted by the model

e_t = Corresponding residual

Through the tests of residuals, it is possible to check whether a model can capture the data. Having below characteristics among residuals convince that the developed model is effective.

01. The residuals should not be correlated. However, if there is a correlation among residuals, then the model should be enhanced to capture the information left out.
02. The residuals should be normally distributed or should have a mean, which is zero or closer to zero. However, if there is a non-normal distribution among residuals, then the forecasts may be biased.
03. The residuals should follow a homoscedastic process.

Accordingly, the below tests have been used to analyse the behaviour of residuals.

White Heteroscedasticity Test

This test measures the variance of the residuals of a designed model. The test follows the hypothesis as in;

H_0 = The residuals follow a homoscedastic process Var $(\varepsilon_i) = \sigma^2$

H_1 = The residuals follow a heteroscedastic process Var $(\varepsilon_i) = \sigma_i^2$

Ljung-Box Test

This test measures the autocorrelation of the residuals in a developed model. If lags of the dependent variable are considered as independent variables in deriving a particular model, then this test is suitable to measure the behaviour of the residuals of such a model.

The Ljung-Box statistic is being measured by using the below formula.

$$Q = n(n+2)\sum_{k=1}^{m}\frac{\hat{p}_k^2}{n-k}$$

N = Sample size

$\hat{p}$ = Sample autocorrelation at lag k

M = Number of lags being tested.

The hypothesis derived is as follows.

H_0 = The residuals of the model are not serially correlated

H_1 = The residuals of the model are serially correlated

CHAPT ER 04

DATA ANALYSIS

4.1 Introduction to the Chapter

Different statistical approaches have been used within this chapter to analyse the effect of macroeconomic variables on CSE performance. The collected data will be analysed statistically to identify the significance of those factors. Thus, section 4.2 illustrates the basic features and nature of the distribution of considered variables based on descriptive statistics. Section 4.3 demonstrates the regression model, while section 4.4 explains the correlation coefficient among the observations. In the meantime, the observed variables' stationarity was tested through unit root tests, and the results were depicted under section 4.5. Section 4.6 to 4.9 develops the factor model. Section 4.10 to 4.16 develops the vector auto-regression model. Section 4.17 to 4.20 develops the GARCH Model, which will be compared with the VAR model later.

4.2 Descriptive Statistics

Monthly data for 213 months has been considered in this research. The economic data from January 2002 – September 2019 was used for analysis. The data is collected on behalf of ASPI and other independent variables such as CCPI, IR, GDP, OP, MS, ER, and GP.

Table 4.4: Descriptive Statistics

	ASPI	CCPI	GP	OP	MS	IR	GDP	ER
Mean	4,230.92	7.93	128,988.10	8,535.52	2,791,805	9.73	1,747,241	122.25
Median	5,180.15	6.60	150,036.10	8,166.63	2,022,307	8.71	1,508,636	113.90
Maximum	7,798.00	23.40	275,314.50	15,680.62	7,396,866	21.30	4,254,550	182.13
Minimum	562.20	0.70	26,288.32	1,820.04	550,198	5.74	392,7012	65.93
Std. Dev.	2,298.11	4.81	67,356.37	3,785.84	2,048,839	3.26	1,100,819	22.97
Skewness	(0.16)	1.28	(0.08)	0.06	0.84	1.45	0.45	0.78
Kurtosis	1.39	4.55	1.68	1.93	2.48	4.39	1.87	2.93
Jarque-Bera	24.00	79.46	15.58	10.30	27.37	91.57	18.55	21.73
Probability	0.00	0.00	0.00	0.005	0.00	0.00	0.00	0.00

As per the results presented in table 4.4, the descriptive statistical analysis has been directed to diagnose the distribution of observations considered in research.

The mean of the ASPI, which is the dependent variable of this study, is 4230.92, with a standard deviation of ± 2298.11. It holds a negative skewness (-0.16), which means left tailed distribution with kurtosis of 1.36. Accordingly, ASPI observations are distributed around the mean with a lower peak compared to normal distribution. It leads to create thick-tailed distribution (kurtosis > 0), which is leptokurtic distribution.

The mean of the CCPI or the economy's inflation rate is 7.93, with a standard deviation of ± 4.81. However, the data set has a positive skewness of 1.28, which means a right-tailed distribution, and the kurtosis of 4.55 (kurtosis > 0) illustrates a leptokurtic distribution with considerably heavy tails.

The mean of GP is 128988.10, with a standard deviation of ± 67356.37. Gold prices are fairly symmetrical since the skewness is close to zero (-0.08), but the kurtosis of 1.68 (Kurtosis > 0) illustrates a leptokurtic distribution with considerably heavy tails.

The mean of OP, which is 8535.52, has a standard deviation of ± 3785.84. However, the skewness (-0.06) is a negative value since it is closer to 0; it is possible to conclude that the data set is fairly symmetrical. Further, the kurtosis of 1.93 (Kurtosis > 0) illustrates a leptokurtic distribution with considerably light tails than other variables.

The mean of MS is 2791805.00, with a standard deviation of ± 2048839.00, which is considered a high deviation. Thus, the skewness (0.84) of the distribution is positive, and the data distribution is right-skewed with kurtosis of 2.48 (kurtosis>0), which illustrates a leptokurtic distribution with heavy tails.

The mean of IR is 9.73, with a standard deviation of ± 3.26. The skewness 1.45 of the data set is positive, and it is a right-skewed distribution with a kurtosis of 4.39 (Kurtosis > 0), which illustrates a leptokurtic distribution with considerably heavy tails.

The mean of GDP is 1747241.00, with a standard deviation of ± 1100819.00. However, the skewness of the data set is 0.45, which means the distribution is right-

skewed. The kurtosis of this series is 1.87 (Kurtosis > 0), which illustrates a leptokurtic distribution with light tails.

The mean of the ER is 122.25, and the standard deviation is ± 22.97. The skewness of the data set is 0.78, which means highly right-skewed, and the kurtosis of the series is 2.93 (Kurtosis > 0), which has a leptokurtic distribution with heavy tails.

The results of the Jarque-Bera test reject H_0 for all the observations (H_0 is rejected since the P-value (0.00) < 0.05). It indicates the non-normal distribution of all the observations. 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.

4.3 Analysis of Trends in Data

As per Shrestha & Bhatta, (2017), economic time series data mostly consist of unique characteristics such as the clear trend of shocks and high volatility throughout a specific period.

Figure 4.3: The Trend of ASPI

As per the trend shown in figure 4.3, ASPI has both structural breaks for both intercept and trend. There is a rapid growth recorded in the 2009 – 2010 period, followed by a

continuous decline trend. The ASPI data distribution is heteroskedastic in its nature, which has unexpected shocks within the market.

Figure 4.4 and 4.10 illustrates the trend analysis of all independent variables.

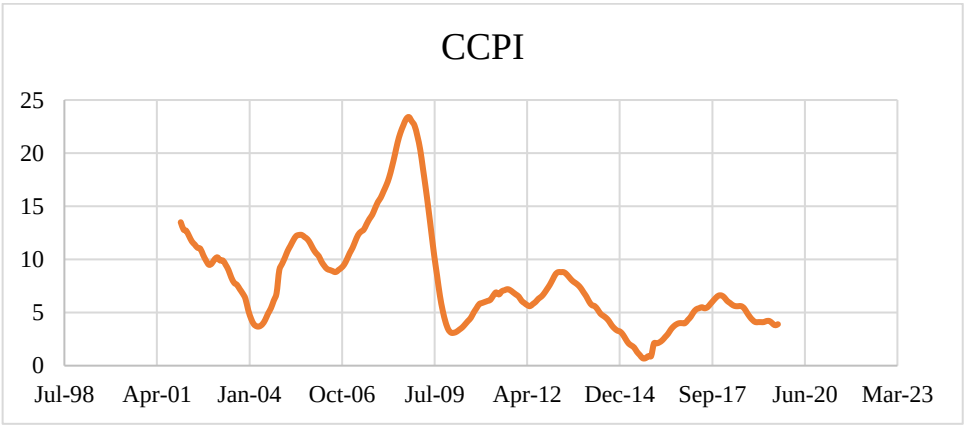


Figure 4.4: Trend Analysis of CCPI

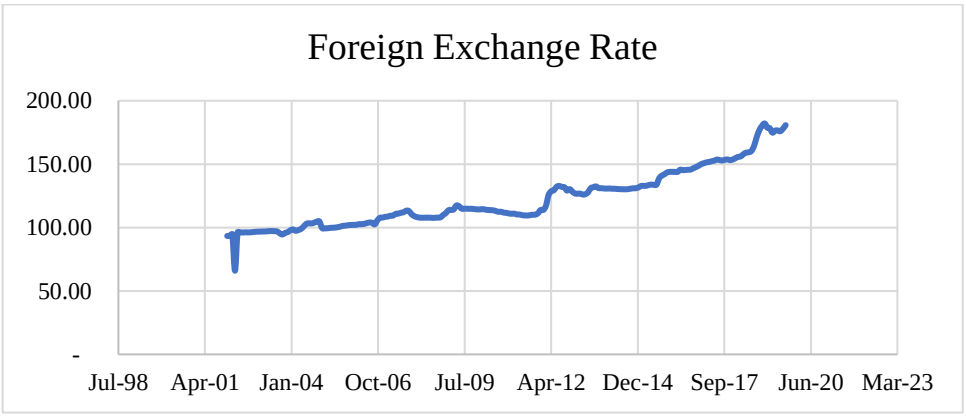


Figure 4.5: Trend Analysis of FER

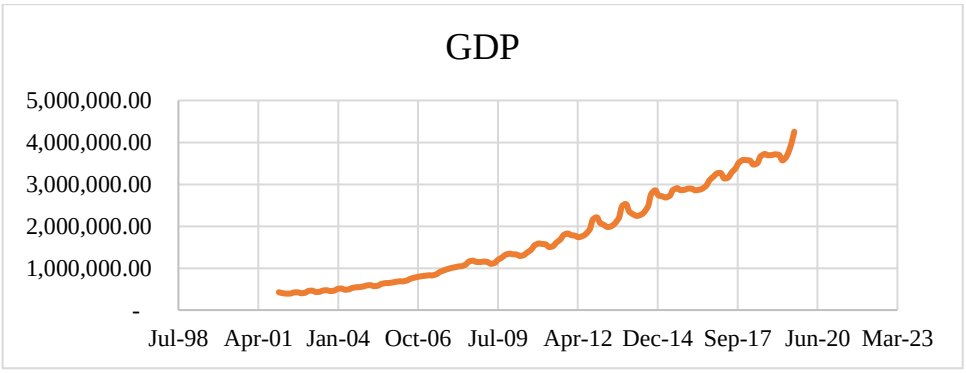


Figure 4.6: Trend Analysis of GDP

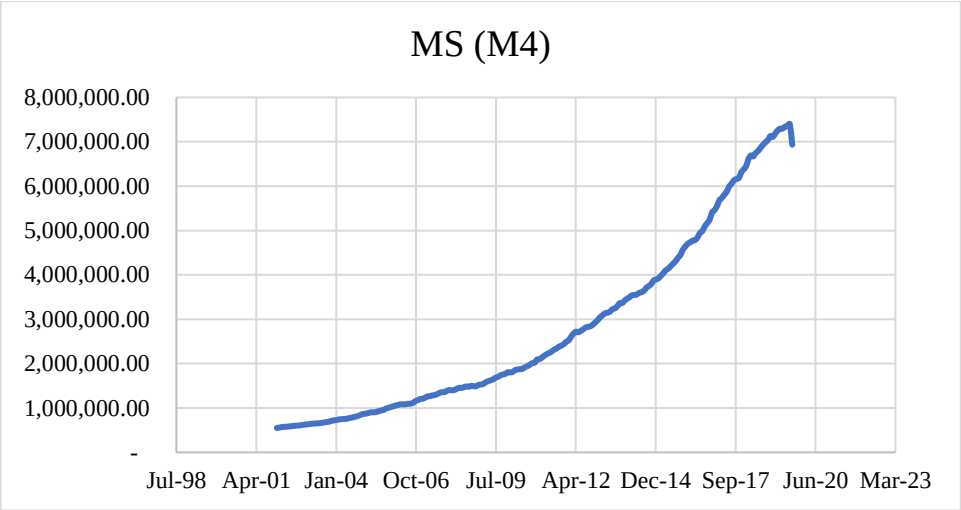


Figure 4.7: Trend Analysis of MS

The trend analysis of CCPI shows a high variation of price level within the Sri Lankan economy. There are structural breaks in the trend. Such conditions may occur disturbances in the planning and forecasting of the business sector. However, other than a few extreme shocks, the rest of the data points are gathered around the same distribution range. Thus, there is a possibility of having a relationship between present CCPI and previous CCPI values. Accordingly, an autoregressive character is possible in the general price level of the Sri Lankan economy. FER, GDP, and MS show a smooth trend with the least shocks. These variables seem to be gradually increasing with time.

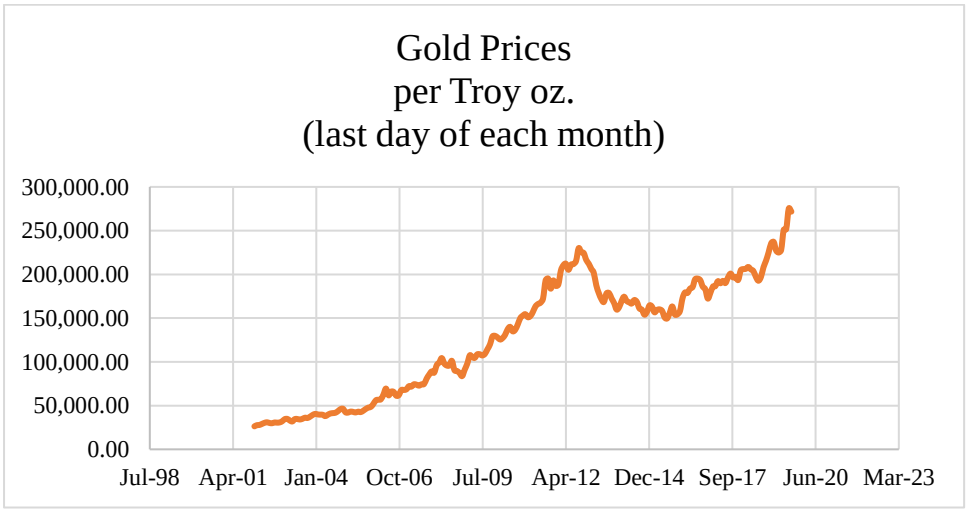


Figure 4.8: Trend Analysis of Gold Prices

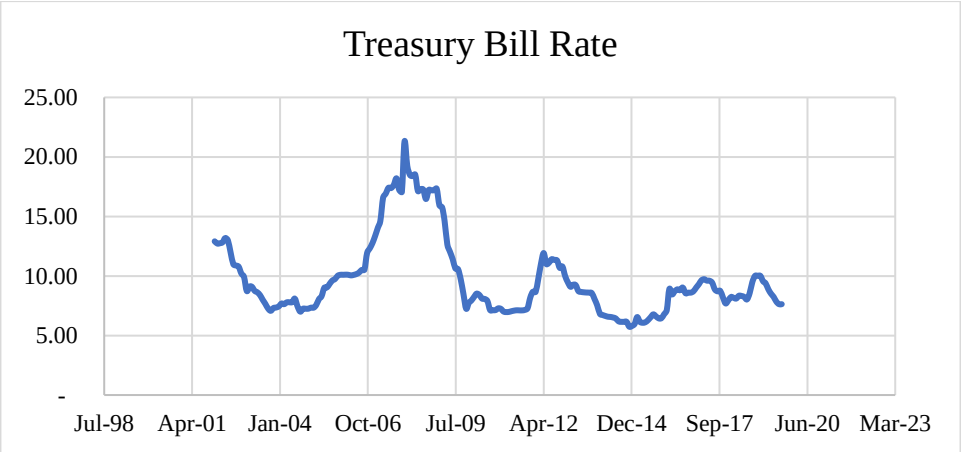


Figure 4.9: Trend Analysis of Treasury Bill Rate

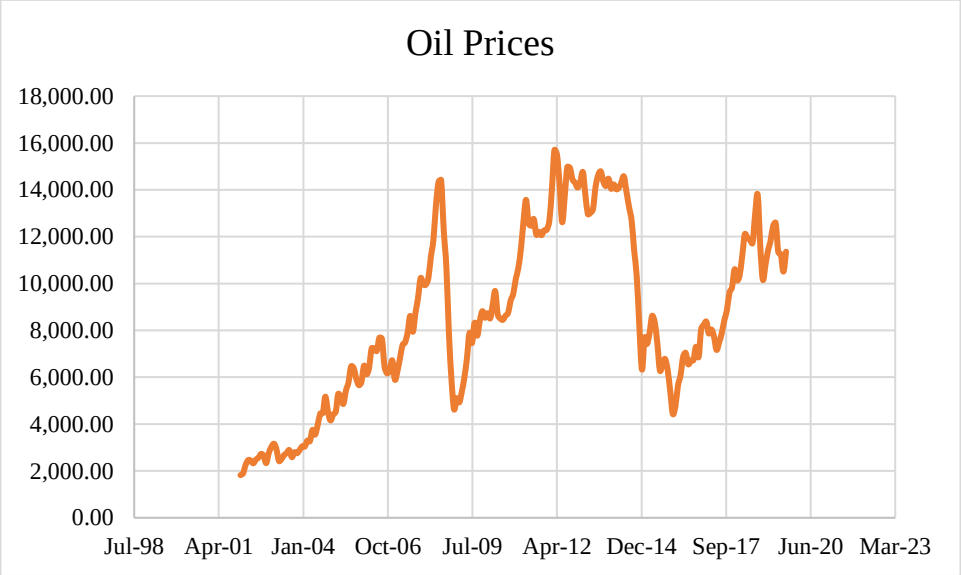


Figure 4.10: Trend Analysis of Oil Prices

However, for OP, GP, and TB, there are structural breaks for both intercept and trend. Thus, those variables seem to be highly sensitive to the respective external factors.

However, when analysing the distribution of data, it can be concluded that there is a possible existence of autoregressive character among all the independent variables defined above. Besides a few shocks, most of the data follow a series of similar data in the same range. So, the lagged values of the time series data can be considered to conduct this study.

4.4 ADF and PP Tests Results.

Unit root analysis was carried to analyse the behaviour of duly collected statistics. Accordingly, ADF and PP tests were conducted for the observed data to identify the distribution's nature. The hypotheses were tested under 5% of the critical value (CV) for the data based on level and first difference (I (0) and I (1), respectively). The findings of the tests and duly reached conclusions are shown below.

Table 4.5: Results based on 5% CV for PP and ADF 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	

As per the results of both the ADF test and 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 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), shows 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, the stationarity is available among all the independent observations at I (1).

4.5 Correlation Coefficient Matrix

It measures the level of the relationship between two variables considered. Accordingly, the correlation has been calculated in-between LN_ASPI and other observed variables to obtain an initial idea about the possible relationships between variables.

Table 4.6: Matrix of Correlation

	LN_ASPI	CCPI	LN_OP	LN_GP	LN_MS	TB	LN_FER	LN_GDP
LN_ASPI	1.000							
CCPI	-0.531	1.000						
LN_OP	**0.814**	-0.134	1.000					
LN_GP	**0.939**	-0.418	**0.841**	1.000				
LN_MS	**0.896**	**-0.501**	**0.688**	**0.931**	1.000			
TB	-0.370	**0.824**	-0.017	-0.221	-0.304	1.000		
LN_FER	**0.774**	-0.486	**0.579**	**0.841**	**0.957**	-0.255	1.000	
LN_GDP	**0.918**	-0.480	**0.723**	**0.954**	**0.993**	-0.290	**0.931**	1.000

When analysing the correlation coefficient between ASPI's log values and other observed variables, the coefficients are considered to be much significant for most 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 considerably 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 the highly correlated variables through multivariate factor analysis (Kumar, 2013)

4.6 Test Appropriateness of Data for FA

The observed variables (manifest variables) will be compiled to a common variable (latent variables) to analyse the study further. Accordingly, before the FA, Bartlett test and KMO were conducted to test the data's appropriateness.

4.6.1 Bartlett Test

Table 4.7: Results of Bartlett's Test

Chi-Square Statistic – Approximate	2739.505
Degree of Freedom	21
Sig.	0.000

The pre-defined hypotheses were tested in the Bartlett test to identify whether at least one batch variance is different from the others. Table 4.7 illustrate the Bartlett test result, which emphasis the rejection of H_0 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.

4.6.2 Kaiser-Meyer-Olkin (KMO) Statistic

The KMO statistic for the observed variables is calculated to assure the sampling adequacy to continue a factor analysis for this study. The KMO statistic adequacy information is illustrated in table 4.8.

Table 4.8: KMO Statistic

The Measure of Sampling Adequacy based on KMO Statistic	0.736

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.

4.7 Extraction of Factors

The extraction of factors has been done based on the PCF method, and components with eigenvalues >1 are considered the factors for the study. As per the assumptions

of PCF, the communalities of observed variables should be equal to one. So that prior estimates have not been considered for the communalities.

Table 4.9: Eigenvalues Calculation

Component	Eigenvalues – Initial calculation			Extraction Sums of Squared Loadings		
	Sum	% Variance	% Cumulative	Sum	% Variance	% Cumulative
1	4.762	68.022	68.022	4.762	68.022	68.022
2	1.566	22.372	90.394	1.566	22.372	90.394
3	.433	6.183	96.577			
4	.145	2.068	98.645			
5	.071	1.014	99.659			
6	.021	.300	99.959			
7	.003	.041	100.000			

Extraction Method: PCA

The Eigen analysis of the correlation matrix is illustrated in Table 4.9. Accordingly, the matrix shows only two eigenvalues, which are greater than one. The first 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.

Table 4.10: Initial Communalities

Observed Variable	Initial Communalities	Extraction
CCPI	1.000	.919
LN_GP	1.000	.956
LN_OP	1.000	.751
LN_MS	1.000	.966
TB	1.000	.903
LN_FER	1.000	.859
LN_GDP	1.000	.974

Extraction Method: PCA.

As per illustrations of table 4.10, the initial communalities under the PCF extraction method is one for all the variables.

Table 4.11: Factor Loadings Without Rotation for the Finalized 2-Factor Model

	Component	
	1	2
CCPI	-.596	**.751**
LN_GP	**.954**	.213
LN_OP	**.746**	.441
LN_MS	**.979**	.087
TB	-.407	**.858**
LN_FER	**.924**	.073
LN_GDP	**.980**	.116

Extraction Method: PCA

Loadings of the 2-factor model without rotation is shown in table 4.11. Accordingly, the majority of the initial variables loaded heavily on the first factor (F1). Since the loadings for the second factor (F2) is less than the corresponding loadings in F1, the initial calculation of factor loadings do not well-defined F2. Since the initial loading is less helpful in defining the factors, the initial factors must be rotated through the orthogonal rotation method to obtain the most rationale definition for F1 and F2.

4.8 Rotation of Factors through Orthogonal Rotation

According to the above results, 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 factor loading after the orthogonal rotation is shown in the below table (Table 4.12). The loadings, which are >0.5, have been highlighted.

Table 4.12: 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

The correlations between the original variables and the common factors are known as factor loadings and illustrated in Table 4.12. Accordingly, the initial variables such as LN_GP, LN_OP, LN_MS, LN_FER, LN_GDP load heavily on F1. Similarly, the initial variables, such as CCPI and TB, load more on F2. The same trend has been repeated in all three orthogonal rotation methods. Thus, all the orthogonal rotations' results provided the same output, so it is rational to extract the factors using the Varimax rotation method under PCF extraction. Table 4.13 illustrated the summarized list of variables of each factor under each rotation method.

Table 4.13: List of Variables Selected for 2-Factors

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

The variables included in factor 1 directly impact on determining the economic growth (Khan, 2015; Chaitip, Chokethaworn, Chaiboonsri, & Khounkhalax, 2015; Chowdhury, Hamid, & Akhi, 2019). Thus, it considers as an **Economic Growth Factor**. The inflation rate and interest rate are key denominators of the time value of money (Chandra & Bahner, 1985; Fierko, Lauer, & Scarpetta, 2000; Kaveh & Dalfard, 2012). Thus, factor 2 will be considered as the **Time Value of Money Factor**.

The final communalities of the two factors obtained from Varimax are shown below. The third column of Table 4.14 shows the difference between initial and final communalities or the variance of the given variable's unique component.

Table 4.14: Final Communalities of Two Factor Model

Rotation Method	Varimax		Final Communalities	(Initial - Final) Communalities
Initial Variable	Component			
	1	2	$\Sigma_{j=1}^{2} \lambda_{ij}^{2}$	$(1 - \Sigma_{j-1}^{2} \lambda_{ij}^{2}) = \psi_i^2$
CCPI	-.268	.921	.919	.081
LN_GP	.964	-.165	.956	.044
LN_OP	.857	.125	.751	.249
LN_MS	.939	-.291	.966	.034
TB	-.052	.949	.903	.097
LN_FER	.883	-.283	.859	.141
LN_GDP	.951	-.264	.974	.026

The calculated final communalities are close to one, and the difference between initial and final communalities 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.

4.9 Factor Score Coefficient

The factor score coefficients under the Varimax method are duly derived and illustrated in Table 4.15 to finalize the multiple linear regression. Accordingly, two common factors can be written as,

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

$$F2 = 0.491CCPI + 0.540TB$$

F_1 is considered as Economic Growth Factor while F_2 is considered as Time Value of Money Factor in the study.

Table 4.15: Factor Score Coefficients with Varimax Factor Rotation

Initial Variable	Component	
	Economic Growth Factor	**Time Value of Money Factor**
CCPI	.066	**.491**
LN_GP	**.237**	.050
LN_OP	**.252**	.201
LN_MS	**.211**	-.027
TB	.129	**.540**
LN_FER	**.197**	-.031
LN_GDP	**.219**	-.009

Extracted factors will be used to derive different models to understand their impact on the stock exchange performance in Sri Lanka.

4.10 Johansen Co-Integration Test

The availability of the long-run relationship between the observations has been measured to determine a suitable econometric model for the processed data.

Accordingly, the macroeconomic data's long-term effect towards ASPI was analysed, and the lags for analysis were determined by the Akaike Information Criterion (AIC).

Table 4.16: Lag Selection Based on AIC

Lag	LogL	AIC	FPE	HQ	SC
0	-644.49	6.71	0.16	6.73	6.76
1	589.31	-5.98	0.00	-5.90	-5.78
2	629.76	-6.31	0.00	-6.16*	-5.95*
3	643.08	-6.35	0.00	-6.15	-5.85
4	656.01	-6.39*	0.00*	-6.13	-5.73

Accordingly, four lags were determined by using AIC criteria (Table 4.16) for further analysis. Similarly, The Final Prediction Error (FPE) also suggested having four lags while Hannan-Quinn Information (HQ) Criterion and SIC suggested two lags.

Table 4.17: Results of Johansen Co-Integration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.067177	27.06048	29.79707	0.1002
At most 1	0.042557	12.59628	15.49471	0.1305
At most 2	0.016925	3.550572	3.841466	0.0595

The trace test indicates no co-integration at the 0.05 level.

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.067177	14.4642	21.13162	0.3282
At most 1	0.042557	9.045704	14.2646	0.2824
At most 2	0.016925	3.550572	3.841466	0.0595

The Max-eigenvalue test indicates no co-integration at the 0.05 level.

The cointegration has been tested for the variables using both the maximum-eigenvalue and the trace tests (Table 4.17). The outcomes accepted the null hypothesis under both methods subject to P (0.3282) > 0.05 and P (0.1002) > 0.05 respectively. Thus, it has been concluded that there is no cointegration equation, or the data series does not create any long-term equilibrium.

4.11 Vector Auto-Regression Model (VAR)

Lack of equilibrium among observed variables within the long-run is confirmed through the co-integration test. Thus, only the short-term impact among the considered

variables was analysed. Accordingly, based on the lag lengths suggested by AIC and SIC, a VAR Model has been derived to explain CSE's performance.

Table 4.18: Lag Selection Criteria

Lag	LR	AIC	FPE	HQ	SC
0	NA	-1.328E+00	5.320E-05	-1.308E+00	-1.278E+00
1	978.0584	-6.304E+00	3.670E-07	-6.223E+00*	-6.104E+00*
2	24.14738	-6.340E+00	3.540E-07	-6.198E+00	-5.990E+00
3	25.45802	-6.385E+00*	3.390E-07*	-6.182E+00	-5.885E+00

Table 4.18 illustrates the lag structure for the VAR model. Accordingly, a maximum of 3 lags was selected based on AIC to develop the model.

Table 4.19: VAR Model

Standard errors in ( ) & t-statistics in [ ]			
	LN_ASPI	F1	F2
LN_ASPI(-1)	1.0468	0.0045	-0.1240
	-0.0710	-0.0306	-0.4220
	[14.7347]	[0.1483]	[-0.2938]
LN_ASPI(-2)	-0.1930	0.0140	0.3103
	-0.1019	-0.0439	-0.6056
	[-1.8938]	[0.3185]	[0.5124]
LN_ASPI(-3)	0.1158	-0.0028	0.0439
	-0.0714	-0.0308	-0.4243
	[1.6216]	[-0.0918]	[0.1035]
F1(-1)	0.0759	1.1986	0.3500
	-0.1649	-0.0710	-0.9795
	[0.4601]	**[16.877]**	[0.3573]
F1(-2)	0.0122	-0.2653	-0.1152
	-0.2531	-0.1090	-1.5035
	[0.0482]	**[-2.4335]**	[-0.0766]
F1(-3)	-0.0790	0.0450	-0.5027
	-0.1629	-0.0702	-0.9678
	[-0.4849]	[0.6411]	[-0.5194]
F2(-1)	-0.0198	-0.0050	1.3403
	-0.0113	-0.0049	-0.0672
	[-1.7558]	**[-1.0362]**	**[19.961]**
F2(-2)	0.0107	0.0030	-0.0297
	-0.0195	-0.0084	-0.1160
	[0.5478]	[0.3591]	[-0.2558]
F2(-3)	0.0059	0.0022	-0.3201
	-0.0115	-0.0050	-0.0683
	[0.5129]	[0.4526]	**[-4.6892]**
C	0.1771	0.1415	1.4364
	-0.1371	-0.0590	-0.8142
	[1.2921]	**[2.3961]**	**[1.7641]**

R-squared	0.9928	0.9982	0.9919
Adj. R-squared	0.9925	0.9981	0.9915
Sum sq. resids	0.7462	0.1385	26.3352
S.E. equation	0.0611	0.0263	0.3629
F-statistic	3064.8740	12137.0300	2717.2140
Log likelihood	294.2050	471.0803	-79.9760
Akaike AIC	-2.7067	-4.3912	0.8569
Schwarz SC	-2.5473	-4.2319	1.0163
Mean dependent	8.1604	12.1167	9.0836
S.D. dependent	0.7043	0.6021	3.9412
Determinant resid covariance (dof adj.)		0.0000	
Determinant resid covariance		0.0000	
Log-likelihood		687.6368	
Akaike information criterion		-6.2632	
Schwarz criterion		-5.7850	

As per table 4.19, the VAR model has been developed based on the factors defined by the factor analysis. Accordingly, the considered endogenous variables are LN_ASPI, Economic Growth Factor, and Time Value of Money Factor. As per the AIC, three lags were selected to develop the model. VAR estimates are OLS estimates that could be interpreted with *"ceteris paribus assumption."*

When analysing the coefficients of the LN_ASPI vector, the lagged values of LN_ASPI has a significant influence in forecasting the current month LN_ASPI. The first lag of LN_ASPI, which means the last month LN_ASPI has 104.68% positive association in determining the current month LN_ASPI (ceteris paribus). LN_ASPI' s second lag, which means the change in the two months ago, has a 19.3% negative association in determining the current month LN_ASPI (*ceteris paribus*). However, the third lag of LN_ASPI, which means the change in the three months ago, LN_ASPI, has an 11.58% positive association in determining the current month LN_ASPI (*ceteris paribus*).

The lagged values of the F1 (Economic Growth Factor) does not show any significance in forecasting the performance of CSE. However, the first lag of F2 (Time Value of Money Factor) shows a 1.98% negative association in determining the current month LN_ASPI (*ceteris paribus*). This means an increment in treasury bill interest rate and inflation rate within the Sri Lankan economy causes to decline in CSE's performance.

Inversely, LN_ASPI lagged values do not significantly influence in determining the macroeconomic factors considered in the study. This emphasizes that the CSE changes have less influence in deviating the Economic Growth Factors or Time Value of Money Factors on average (*ceteris paribus*).

4.12 Variance Decomposition in VAR

Table 4.20: VAR Variance Decomposition

Variance Decomposition of LN_ASPI:				
Period	S.E.	LN_ASPI	F1	F2
1	0.0611	100.0000	0.0000	0.0000
2	0.0893	99.3071	0.0466	0.6463
3	0.1069	97.7648	0.2088	2.0265
4	0.1215	95.8536	0.3061	3.8403
5	0.1348	93.7840	0.3433	5.8727
6	**0.1470**	**91.5841**	**0.3659**	**8.0500**
7	0.1582	89.3068	0.3895	10.3038
8	0.1685	87.0041	0.4170	12.5789
9	0.1781	84.7128	0.4503	14.8369
10	0.1871	82.4558	0.4909	17.0533
11	0.1955	80.2490	0.5400	19.2110
12	**0.2034**	**78.1034**	**0.5985**	**21.2981**
13	0.2109	76.0262	0.6674	23.3064
14	0.2178	74.0224	0.7471	25.2304
15	0.2244	72.0949	0.8384	27.0667
16	0.2306	70.2454	0.9417	28.8129
17	0.2365	68.4746	1.0574	30.4680
18	0.2420	66.7824	1.1858	32.0318
19	0.2473	65.1682	1.3271	33.5047
20	0.2522	63.6311	1.4814	34.8875
21	0.2569	62.1695	1.6488	36.1817
22	0.2613	60.7818	1.8292	37.3890
23	0.2655	59.4659	2.0225	38.5115
24	**0.2694**	**58.2199**	**2.2286**	**39.5515**

Variance Decomposition of F1:				
Period	S.E.	LN_ASPI	F1	F2
1	0.0263	1.6230	98.3770	0.0000
2	0.0411	1.8248	97.9784	0.1968
3	0.0517	2.3783	97.0182	0.6036
4	0.0600	3.0595	95.8241	1.1163
5	0.0672	3.7502	94.5849	1.6649
6	**0.0736**	**4.4301**	**93.3626**	**2.2073**
7	0.0793	5.1008	92.1775	2.7217

8	0.0846	5.7606	91.0409	3.1985
9	0.0895	6.4073	89.9580	3.6346
10	0.0941	7.0400	88.9291	4.0309
11	0.0984	7.6583	87.9514	4.3903
12	**0.1025**	**8.2624**	**87.0210**	**4.7166**
13	0.1064	8.8524	86.1335	5.0141
14	0.1101	9.4284	85.2848	5.2868
15	0.1136	9.9907	84.4708	5.5385
16	0.1169	10.5393	83.6878	5.7729
17	0.1201	11.0743	82.9329	5.9928
18	0.1232	11.5958	82.2032	6.2011
19	0.1262	12.1035	81.4965	6.4000
20	0.1291	12.5976	80.8109	6.5915
21	0.1319	13.0778	80.1448	6.7774
22	0.1346	13.5440	79.4970	6.9590
23	0.1372	13.9962	78.8663	7.1376
24	**0.1397**	**14.4340**	**78.2519**	**7.3141**

Variance Decomposition of F2:				
Period	S.E.	LN_ASPI	F1	F2
1	0.3629	0.5736	0.0051	99.4213
2	0.6074	0.7115	0.0450	99.2435
3	0.8834	0.5963	0.0984	99.3054
4	1.1438	0.4481	0.1091	99.4428
5	1.3935	0.3190	0.0975	99.5834
6	**1.6253**	**0.2348**	**0.0778**	**99.6874**
7	1.8399	0.2043	0.0608	99.7349
8	2.0365	0.2326	0.0538	99.7136
9	2.2161	0.3215	0.0621	99.6164
10	2.3796	0.4711	0.0895	99.4393
11	2.5280	0.6801	0.1386	99.1813
12	**2.6625**	**0.9460**	**0.2112**	**98.8428**
13	2.7843	1.2655	0.3082	98.4263
14	2.8946	1.6343	0.4303	97.9354
15	2.9944	2.0480	0.5773	97.3747
16	3.0847	2.5011	0.7491	96.7498
17	3.1664	2.9883	0.9446	96.0670
18	3.2403	3.5038	1.1631	95.3331
19	3.3073	4.0418	1.4030	94.5553
20	3.3679	4.5963	1.6628	93.7408
21	3.4229	5.1617	1.9409	92.8974
22	3.4727	5.7322	2.2354	92.0324
23	3.5180	6.3025	2.5443	91.1532
24	**3.5591**	**6.8677**	**2.8654**	**90.2669**
Cholesky Ordering: LN_ASPI F1 F2				

“Variance decomposition is a classical statistical method in multivariate analysis for uncovering simplifying structures in a large set of variables” (Lütkepoh, 2010). Thus, this has been used in the macroeconomic analysis to explain the relationship between variables described by the VAR model. The variance decomposition will be analysed by considering both short-run and long-run periods.

Thus, in the current study, a 6-month and 12-month period has been considered as short-run while beyond the 12th month has been considered as long-run.

As per the table 4.20, in the short run, within the 6th month, the shock to LN_ASPI can cause 91. 58% of fluctuation in future LN_ASPI (Own Shock). However, the F1 (Economic Growth Factor) has a non-noticeable influence in creating a future LN_ASPI variation. A shock to F2 (Time Value of Money Factor) can cause an 8% fluctuation in future LN_ASPI.

When analysing the long-run, within the 24th Month, the LN_ASPI shock can cause 58.21% of fluctuation in future LN_ASPI (Own Shock). However, the F1 (Economic Growth Factor) has only a minimal influence in creating a variation in future LN_ASPI. But a shock to F2 (Time Value of Money Factor) can cause 39.55% of fluctuation in future LN_ASPI. This emphasizes that in the long run, shock in time value of money factors can cause to deviate CSE's performance significantly.

Inversely, a shock to LN_ASPI can cause to create 4.43% of the variation in Economic Growth Factors and 0.2% of the variation in Time Value of Money Factors in the short-run (within 6th month). This means the changes that occur within CSE's performance don’t significantly influence the macroeconomic environment within the country in the short run.

Further, a shock to LN_ASPI can cause to create 14.43% of the variation in Economic Growth Factors and 6.87% of the variation in Time Value of Money Factors in the long-run (24th Month). Thus. The volatility of the CSE performance indicators has a nominal influence in varying the long-run macroeconomic factor in Sri Lanka.

4.13 Wald Test

As per the VAR model output illustrated in Table 4.19, a significant variance was identified among the P values variables. Accordingly, the Wald test was directed to identify the collective influence of each observed variable's lagged values when defining the LN_ASPI. The model was enhanced further by considering the overall results of the Wald test. Thus, less significant variables will be eliminated from the model to obtain the best fit model.

Table 4.21: Wald Test Results

Test Statistic	Value	df	Probability
Chi-square	25193.7	3	0.0000

Null Hypothesis: C (1) = C (2) = C (3) = 0
Null Hypothesis Summary:

Normalized Restriction (= 0)		Value	Std. Err.
C (1)		1.074497	0.071026
C (2)		-0.190846	0.103613
C (3)		0.101735	0.070315

Restrictions are linear in coefficients.

Test Statistic	Value	df	Probability
Chi-square	0.6784	3	0.8783

Null Hypothesis: C (4) = C (5) = C (6) = 0
Null Hypothesis Summary:

Normalized Restriction (= 0)		Value	Std. Err.
C (4)		0.0750	0.1659
C (5)		0.0896	0.1694
C (6)		-0.0592	0.1640

Restrictions are linear in coefficients.

Test Statistic	Value	df	Probability
Chi-square	7.4350	3	0.0593

Null Hypothesis: C (7) = C (8) = C (9) = 0
Null Hypothesis Summary:

Normalized Restriction (= 0)		Value	Std. Err.
C (7)		-0.0142	0.0119
C (8)		-0.0070	0.0121
C (9)		-0.0097	0.0119

Restrictions are linear in coefficients.

Hypotheses were developed to analyse the collective significance influence among the defined variable, LN_ASPI, and lagged variables' coefficients. Accordingly, three (03) tests were done for the variables.

The Wald test results (Table 4.21) confirms that the H_0 has been rejected for lagged values of past data of LN_ASPI with P = (0.000) < 0.05. Accordingly, it emphasizes that there is a significant influence from the past data of LN_ASPI collectively when defining the dependent variable. However, the Wald test results for the lagged values of the Economic Growth Factor and Time Value of Money Factor accept the null hypothesis; thus, it concludes that there is no significant influence from both the factors model's lagged values.

4.14 Granger Causality Test

The observed variables' usefulness to forecast another has been tested through the Granger Causality Test (Table 4.22). The term “Granger-cause” emphasizes the precedence or checks whether the particular variable comes before the other (Leamer, 1985).

As per the results, F1 or the Economic Growth Factor does not Granger Cause LN_ASPI. The null hypothesis was accepted (P = 0.8720 > 0.5). Vice-versa LN_ASPI does not Granger Cause F1 or the Economic Growth Factor. The null hypothesis was accepted (P = 0.5796 > 0.5). So that, Economic Growth Factors and performance of CSE does not maintain a short-run equilibrium within the economy.

However, the results for F2 reject the null hypothesis (P = 0.0051 < 0.05) and confirm a Granger Causality between F2 or Time Value of Money Factor and LN_ASPI. So, the Time Value of Money and the performance of CSE create a short-run equilibrium within the Sri Lankan economy. However, the results confirmed that LN_ASPI does not Granger Cause F2 or Time Value of Money Factor (P = 0.9659 > 0.5).

When analysing the Granger Causality between Economic Growth Factors and Time Value of Money Factors, both confirmed that the variables does not Granger Cause to each other. (P = 0.7075 > 0.5 & P = 0.7844 > 0.5).

Table 4.22: Granger Causality Results

Null Hypothesis:	Obs	F-Statistic	Prob.
F1 does not Granger Cause LN_ASPI	210	0.2349	0.8720
LN_ASPI does not Granger Cause F1		0.6568	0.5796
F2 does not Granger Cause LN_ASPI	210	4.3846	**0.0051**
LN_ASPI does not Granger Cause F2		0.0892	0.9659
F2 does not Granger Cause F1	210	0.4643	0.7075
F1 does not Granger Cause F2		0.3566	0.7844

4.15 Test of Residuals

The behaviour of the residuals has been studied through Serial Correlation, Heteroscedasticity, and Normality of the residuals. It confirms the optimality of the VAR model developed to explain the performance of CSE.

Accordingly, the White Heteroscedasticity Test, Autocorrelation LM test, and Cholesky of Covariance Test have been conducted to check the homoscedasticity of residuals, lack of serial correlation residuals, and normal distribution of residuals respectively.

4.15.1 White Heteroscedasticity Test

The heteroscedasticity test for the residuals confirms a constant variance between the residuals at a 95% confidence level.

As per heteroscedasticity test results illustrated in the below table 4.23, the residuals of both the variables accept the H_0. Accordingly, the test probabilities are more significant ($P < 0.05$), and it confirms that the residuals are homoscedastic. Thus, there is no bias in the distribution of the residuals.

Table 4.23: White Heteroscedasticity Test of VAR Residuals

Joint test:					
Chi-sq	df	Prob.			
228.1787	108	0.0000			
Individual components:					
Dependent	R-squared	F (18,191)	Prob.	Chi-sq (18)	Prob.
res1*res1	0.2425	3.3969	0.0000	50.9243	0.0001
res2*res2	0.3323	5.2817	0.0000	69.7898	0.0000
res3*res3	0.1649	2.0955	0.0074	34.6319	0.0105
res2*res1	0.2302	3.1731	0.0000	48.3415	0.0001
res3*res1	0.1824	2.3677	0.0021	38.3097	0.0035
res3*res2	0.1343	1.6467	0.0524	28.2105	0.0589

4.15.2 Autocorrelation LM test

This test was conducted to ensure no additional information to be apprehended through the VAR model. Accordingly, the residuals have been tested with ten lags to ensure the null existence of serial correlation. Therefore, the LM test has been used to measure the serial correlation among residuals.

Table 4.24: Results Serial Correlation LM Test of VAR Residual

Lags	LM-Stat	Prob
1	23.48596	0.0052
2	23.14283	0.0059
3	15.96862	0.0675
4	16.5417	0.0564
5	14.67788	0.1002
6	4.466084	0.8782
7	5.64993	0.7744
8	5.76716	0.763
9	16.73214	0.0531
10	5.241507	0.8128

The null hypothesis has been rejected with 5% significance level for first four lags ($P = 0.0052 < 0.05$) and later the null hypothesis has been accepted ($P = 0.1002 > 0.05$) (Table 4.24). So, the null existence of a serial correlation between residuals can be seen in long-run up to 10 lags of the VAR model.

4.15.3 Cholesky of Covariance Test

The symmetrical distribution of the residuals has been analysed by using the Cholesky of Covariance Test.

Table 4.25: Results of Normality Test: Cholesky (Lutkepohl) of VAR Residual

Component	Skewness	Chi-sq	df	Prob.
1	0.2953	3.0522	1	0.0806
2	-0.3504	4.2984	1	0.0381
3	1.4240	70.9764	1	0.0000
Joint		78.3270	3	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	4.2480	13.6289	1	0.0002
2	3.4754	1.9777	1	0.1596
3	17.2393	1774.1380	1	0.0000
Joint		1789.7450	3	0.0000

Component	Jarque-Bera	df	Prob.
1	16.6812	2	0.0002
2	6.2761	2	0.0434
3	1845.1150	2	0.0000
Joint	1868.0720	6	0.0000

The results specified in Table 4.25 emphasis the skewness of the residuals of component 01, which is close to zero with considerably a high kurtosis. But the skewness of component 02 is negative, and the peak is considerably high, which means that there is a left-tailed distribution for the residuals.

Similarly, the Jarque-Bera test statistic and its probability value (P = 0.0000), which is less than 5% of significance level, confirm the non-normal distribution of residuals.

4.16 Impulse Response Function

The impulse response function illustrates the endogenous variable's responsiveness to the innovations or the shocks of the endogenous variables. This can be illustrated graphically as follows.

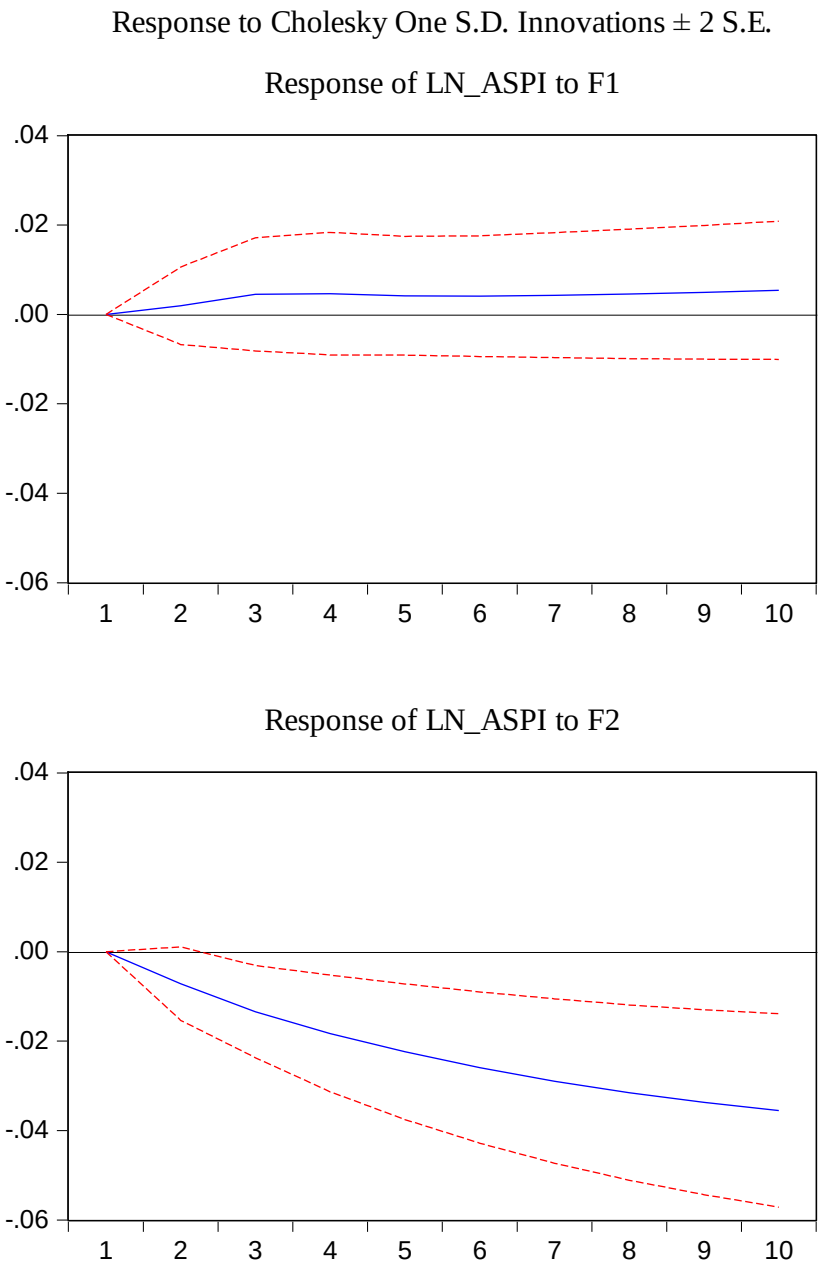


Figure 4.11: Impulse Response Analysis

Figure 4.11 illustrates the response of LN_ASPI on the shocks of Economic Growth Factors (F1) and the response of LN_ASPI on the shocks of Time Value of Money Factors (F2). Both the impulse response functions are within the range of 95% confidence level.

When analysing LN_ASPI's response on the shocks of the Economic Growth Factors, up to the third period, it shows an increment, and after that, the responsiveness

becomes stable. This means the CSE does not respond to the shocks of the Economic Growth Factors (F1). However, when analysing the response of LN_ASPI on the shocks of the Time Value of Money Factors, it shows a continuous decline in response to LN_ASPI, and it is negative. This means the CSE negatively responds to the Time Value of Money Factors (F2).

4.17 Heteroscedasticity Test for Time-Series Data

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

Table 4.26: ARCH LM test

F-statistic	15.91343	P (F) (1,209)	0.0001
Observations x R^2	14.92901	P (χ^2) (1)	0.0001

Accordingly, the H_0 has been rejected with 5% significance level ($P = 0.0001 < 0.05$). So that, the ARCH effect is existing among the considered observations (Table 4.26).

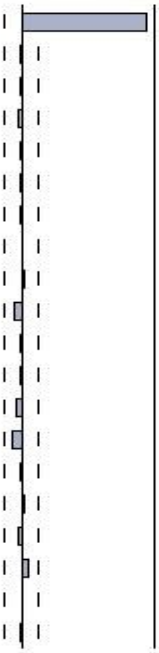
4.18 Partial Auto Correlation (PAC) and Auto Correlation (AC)

The correlation among the observations of two consecutive time spots has been measured by using the AC function. Similarly, the relationship among the observations at two-time spots given, which can be either last month or month before last, has been measured using the PAC function.

As per the results of ARCH LM, since LN_ASPI is heteroscedastic, AC and PAC have been plotted to identify the own effect of LN_ASPI on the forecasting variable (dependent variable).

As per Table 4.27, 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).

Table 4.27: Correlogram of Squared Residuals

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

4.19 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 that, GARCH (1,1) model was developed based on one lag of LN_ASPI and one lag of the endogenous variables (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 Time Value of Money Factors of the current month illustrate a significance of its coefficients through the probabilities less than 5%. The coefficient of the current month Economic Growth Factor is not significant in forecasting CSE's current month performance (Table 4.28). Accordingly, it was decided to enhance the model by eliminating the insignificant element (F1).

Table 4.28: GARCH (1,1) Model - Initial

GARCH = C (5) + C (6) *RESID (-1) ^2 + C (7) *GARCH (-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
LN_ASPI (-1)	0.950061	0.015244	62.3237	0.0000
F1	0.026416	0.016746	1.577458	0.1147
F2	-0.003345	0.000961	-3.481197	0.0005
C	0.125801	0.096157	1.308294	0.1908
Variance Equation				
C	0.000258	0.000152	1.704331	0.0883
RESID (-1) ^2	0.207684	0.068207	3.044926	0.0023
GARCH (-1)	0.732159	0.09073	8.069661	0.0000
R-squared	0.99294	Mean dependent var		8.143899
Adjusted R-squared	0.992838	S.D. dependent var		0.721057
S.E. of regression	0.06102	Akaike info criterion		-2.88946
Sum squared resid	0.774476	Schwarz criterion		-2.77863
Log-likelihood	313.2828	Hannan-Quinn criter.		-2.844665
Durbin-Watson stat	1.781662			

Table 4.29: GARCH (1,1) Model - Enhanced

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 4.29, the coefficients for the conditional mean equation has 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 emphasis that the ASPI of the previous month has 97.26% of sensitivity in determining the current month performance of CSE. And also, the Time Value of Money Factors shows a negative influence in determining the current month 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 β_1 coefficient is also higher, explaining the volatility, which takes a long time to change the market. The coefficient of α_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.

And the R squared resulted in 99.28%, which convinced the model's ability to define its test variables significantly. The Durbin-Watson statistic is 1.809. Since it is closer to the thumb rule value of 2 indicates the possibility of having a least or no correlation within the sample.

Accordingly, the conditional variance and mean equations respectively as follows;

$$\sigma t = 0.0002 + 0.1989|u_{t-1}| + 0.7459\ \sigma_{t-1}$$

$$\log y_t = 0.2590 + 0.9726\ y_{t-1} - 0.0029F_1 + u_t,$$

4.20 Tests of Residuals

The developed GARCH model residuals were analysed to identify whether the residuals are impacting the model considerably. White Heteroscedasticity Test, Ljung-Box Q Test, and Test of Normality of Errors were conducted to confirm residuals' homoscedasticity, lack of serial correlation among residuals, and normal distribution of residuals respectively.

4.20.1 White Heteroscedasticity Test

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.

Table 4.30: White Heteroscedasticity Test

F-statistic	0.0226	P(F) (2,209)	0.9776
Observations x R^2	0.0459	P(χ^2) (2)	0.9773
Scaled explained SS	3915.5860	P(χ^2) (2)	0.0000

4.20.2 Ljung-Box Q Test

The existence of a serial correlation between the residuals confirms that further information is available and should be captured when developing this model. Accordingly, the Ljung-Box Q Test analysed the behaviour of residuals.

Ten lags of the residuals of the model were considered for the above test. Accordingly, the serial correlation of nature was identified based on AC and PAC functions. The Q statistic's significance was evaluated with a 95% confidence level to reach to a conclusion. Table 4.31 illustrates the test results of the Ljung-Box Q test.

Table 4.31: The Results of Testing Correlation of Residuals - Ljung-Box Q Test

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	0.097	0.097	2.0140	0.156
		2	-0.034	-0.044	2.2710	0.321
		3	0.032	0.040	2.4919	0.477
		4	0.082	0.074	3.9441	0.414
		5	-0.054	-0.068	4.5818	0.469
		6	-0.059	-0.043	5.3580	0.499
		7	-0.031	-0.031	5.5720	0.591
		8	-0.007	-0.008	5.5844	0.694
		9	0.070	0.084	6.6803	0.670
		10	-0.051	-0.062	7.2615	0.701

*Probabilities may not be valid for this equation specification.

Thus, the test has been conducted for ten lags, and the probabilities of the Q statistic are significant, with a 95% confidence level (Table 4.31). Accordingly, no serial

correlation has been identified among the residuals. So, the model has captured almost all the information pertains to the market.

4.20.3 Test of Normality of Errors

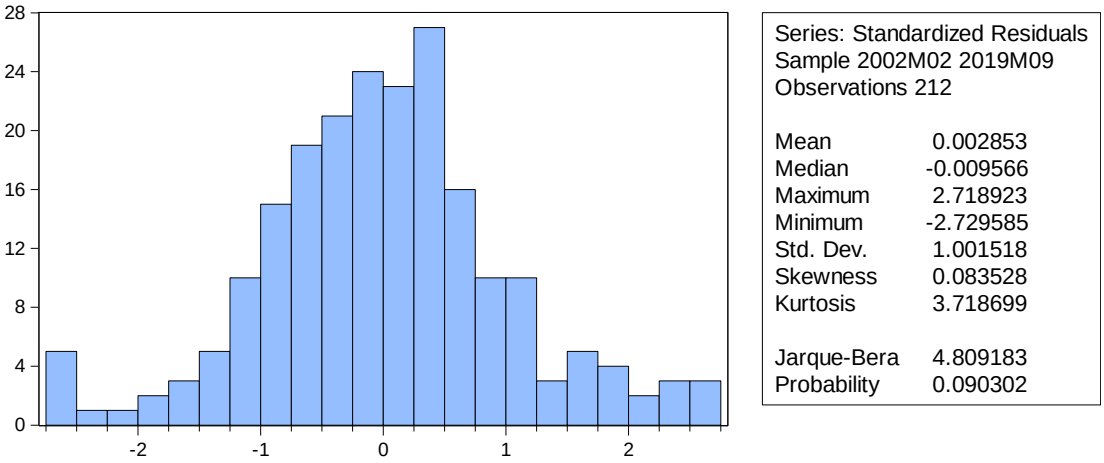


Figure 4.12: Test of Normality of Errors

The residuals distribution has been tested, 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 (3.7187), is approximately three, respectively, signals a normal distribution of residuals. Similarly, the Jarque-Bera test confirms the symmetrical distribution of residuals (P (0.09) >0.05). The GARCH model can be used for further analysis and forecasts for stock exchange performance in Sri Lanka.

CHAPTER 05

CONCLUSION

5.1 Introduction to the Chapter

This chapter discusses the responsiveness of the share market towards the changes that occur in the macroeconomic environment. The findings will be critically evaluated through a rational discussion to achieve the objectives set for this research.

5.2 Summary of the Results

5.2.1 Summary of the VAR model

The current study focuses on streamlining the significant macroeconomic factors affecting the Sri Lankan economy's share market performance. Two hundred thirteen monthly data samples were collected to analyse the share market performance of Sri Lanka.

As per descriptive statistics, the raw macroeconomic data are non-normally distributed. Moreover, the time-series data of CCPI, OP, GP, and TB show structural breaks for both intercept and trend. Thus, the effect of heteroscedasticity exists among those variables. FER, GDP, and MS show a smooth trend with the least shocks. However, the existing shocks have affected to create a heteroscedasticity effect among those variables.

The study was conducted based on the multivariate factor analysis method, which filtered the independent variables into two factors using the varimax rotation method. The factor values were calculated using the factor coefficients. The factor rotation results suggested having LN_GP, LN_OP, LN_MS, LN_FER, LN_GDP in one factor, which was identified as Economic Growth Factor, while CCPI and TB in another factor named as Time Value of Money Factor.

The co-integration was tested using the Johansen co-integration test, considering the factor coefficients. As per test results, no long-run equilibrium is revealed among the independent variables and dependent variables.

Further, the ADF test results emphasize that all the independent variables are stationary at I (1). Thus, the VAR model was selected to analyse the stock exchange's performance parallel to the changes that occur among the duly identified independent factors.

As per the VAR model results, lagged values of ASPI and the first lag value of Time Value of Money Factor (F2) significantly affect the stock exchange's performance. Variance decomposition also confirmed that both in the short-run and long-run, CSE's previous performance and the impact of Time Value of Money factors have a considerable influence in determining CSE's current performance. However, Economic Growth Factors have the slightest effect on determining the current performance of CSE. As per R-squared, the reliability of the VAR model is 99.25%

The Wald test results also confirmed a significant influence from the lagged coefficients values of ASPI collectively define the dependent variable. In comparison, the collective coefficients of lagged Economic Growth Factor (F1) and Time Value of Money Factor (F2) are considered less significant in defining the dependent variable.

Granger Causality test also confirms the VAR model's findings with its results and ensures a Granger Causality between F2 or Time Value of Money Factor and LN_ASPI. Thus, it is possible to verify that there is a short-term equilibrium between the considered variables.

The Impulse response function confirms a negative relationship between the shocks that occur within the Time Value of Money Factor and LN_ASPI. However, the results confirmed that the Economic Growth Factor's shocks have a stable impact on CSE’s performance.

Heteroscedasticity, serial correlation, and normality of the residuals have been tested for the defined VAR model. The results of the White Heteroscedasticity test statistic

concluded the homogeneousness of the residuals. Accordingly, there is an identifiable pattern among the distribution of residuals. The autocorrelation LM test confirms that there is no serial correlation among the developed VAR model residuals in the long run; however, a serial correlation can be seen within the first four lags. The results of the Cholesky of Covariance Test show a non-normal distribution of residuals due to the existence of extreme shocks in the economic data.

5.2.2 Summary of the GARCH model

The ARCH effect was analysed among the dependent variable (ASPI) and independent variables (Economic Growth Factor and Time Value of Money Factor). The results of the ARCH LM test confirm the existence of the ARCH effect among the variables. Accordingly, the GARCH model was derived using the lagged values of the dependent and endogenous variables' values.

The conditional mean equation's coefficients confirmed that the first lag of LN_ASPI has the most significant influence in determining CSE's performance. Further, the Time Value of Money Factor also shows a negative but significant impact in determining the LN_ASPI. The coefficient of AR (1)-parameter explains the effect of last month ASPI on the model, which has a high coefficient considerably. Further, the findings revealed 97.26% of influence from the prior month's ASPI towards ASPI's behaviour.

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 β_1 coefficient is also higher, explaining the volatility, which takes a long time to change CSE's performance. The coefficient of α_1 explains that the volatility of LN_ASPI is moderate and moderately responding to the market movement. Similarly, the sum of the ARCH coefficients (0.0002 + 0.1989 + 0.7459) is closer to one that convinces volatility shocks' persistence.

The heteroscedasticity results, serial correlation, and normality of the residuals of the defined GARCH model confirmed homoscedasticity among the residuals of the GARCH model. Ljung-Box Q test results confirm that there is no serial correlation

between the residuals. The normality test for residuals also affirms that the residuals are distributed normally.

5.3 Conclusion

As per the study's findings, both the models confirm that ASPI's lagged values have a high capacity for forecasting future stock exchange performance in Sri Lanka. Accordingly, the past data of ASPI is considered a significant indicator of the stock exchange's performance.

Thus, the findings support the theory of APT (Ross, 1976), which explains that the systematic risk or the non-diversifiable proportion of the risk of returns can be impacted by the performance of the external factors and movements of the stock market.

When analysing the impact of macroeconomic variables, the VAR model confirms that Economic Growth Factors considered in the study, such as gold price, oil price, money supply, exchange rate, and gross domestic production, are less significant in determining the share market performance. Thus, the shocks that occur within the macroeconomic environment have less influence in determining the CSE's overall performance. Simultaneously, the Time Value of Money Factor, inflation rate, and Treasury bill rate are considerably significant in determining CSE's Sri Lanka performance. Further, the findings revealed a negative relationship between the Time Value of Money Factor and CSE performance.

As per the findings, it is essential to maintain a low inflation rate and risk-free interest rate to enrich CSE's performance. Thus, the results emphasise the importance of maintaining a stable internal value of the currency unit. By adhering to the findings, the Sri Lankan economy can develop an investor-friendly environment to attract more investors to the Sri Lankan capital market.

Sri Lanka is mostly focusing on expansionary monetary policy. Expansionary monetary policy is considered inflationary to the domestic economy. Thus, the

policymakers have to pay their attention to the quantitative and qualitative credit controls that they adhere to ensure a strong capital market within Sri Lanka.

The GARCH model results emphasize that the effect of ASPI's lagged values is highly influential in analysing the stock exchange performance. In contrast, the impact of the shocks occur within the conditional mean equation is considered nominal. As per the mean equation, ASPI's lagged values have 97.26% of influence in forecasting the share market's future performance.

As per the results of the variance equation, the GARCH model that illustrates a higher β_1 coefficient also convinces the existence of the volatility, which takes a long time to change, moreover, the coefficient of α_1 explains that the volatility of ASPI is moderate and moderately responding to the market movement.

The VAR model's output and the GARCH model confirmed that the Time Value of the Money Factor significantly influences CSE's performance. At the same time, the Economic Growth Factor has an insignificant influence on the same. So, the enhancement of CSE performance can be obtained by maintaining a well-performing and high liquid capital market while having a low inflation rate and Treasury bill rate. Thus, speculative investors can actively perform in the Sri Lankan share market by paying much attention to the above three variables. Similarly, economic policy-makers should pay much attention to controlling inflation and risk-free interest rates to assure the share market's better performance.

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