RELATIONSHIP BETWEEN MACROECONOMIC FACTORS AND STOCK PRICE INDEX:
THE CASE OF DAR ES SALAAM STOCK EXCHANGE MARKET IN TANZANIA

BY
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A Dissertation Submitted in Partial/Fulfilment of the Requirements for Award of Degree of Master of Science in Accounting and Finance (MSc. A&F) of Mzumbe University

December, 2020
CERTIFICATION

We, the undersigned, certify that we have read and hereby recommend for acceptance by the Mzumbe University, a dissertation entitled “Relationship between macroeconomic factors and stock price index: The Case of Dar es Salaam stock exchange market in Tanzania” in partial fulfilment of the requirement for the award of the degree of Master of Science in Accounting and Finance (MSc. A&F) of Mzumbe University.

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I, Allen Msabaha, declare that this dissertation is my original work and that it has not been presented and will not be presented to any other university for similar or any other degree award.

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I want also to thank my parents, Mr. and Mrs. Sylivester Msabaha, my wife, and kids for their support.
DEDICATION

I dedicate this research work to my lovely wife, Magdalena Ezekiel for her love, endurance, and support not only for me but also for my daughters, Ellen and Evelyn.

This work is also a dedication to my best friend and my neighbours in general for their understanding, encouragement and taking care of my daughters for all the time that I was away pursuing my studies.
ABSTRACT

This study mainly investigated the relationship between the macroeconomic factors and stock price index at DSE. Specifically, the study intended to examine the relationship between the inflation rate and stock price index (DSEI) at DSE; to examine how interest rate relates to the stock price index (DSEI) at DSE; to examine the relationship between exchange rate and stock price index (DSEI) at DSE; to examine the relationship between money supply and stock price index (DSEI) at DSE. Research was carried out at Dar es Salaam Stock Exchange (DSE).

The causal research design with the quantitative approach was used to study macroeconomic factors and stock price index relationship at DSE whereby the monthly data of stock price index for the last eight years (2012-2019) was taken from DSE. The descriptive and time-series analyses were performed per specific objectives, and hypotheses. The research used preliminary tests such as unit root test (Augmented Dickey-Fuller test), Optimal Lag Length Selection, and Co-integration test to see the fitness of data for further time series tests. Additionally, the study made the test of Granger causality, and Vector Auto-Regressive (VAR).

Generally, the findings of the VAR model show that the exchange rate, inflation rate, interest rate, and money supply were insignificant related to the stock price index. The study further reveals that there is no long-run relationship between macroeconomic variables and stock price index. The study concludes that the exchange rate, inflation rate, interest rate, and money supply are insignificant related to the stock price index in the DSE market and have no co-integration.

The policy implication of the study suggests that it is very imperative to design monetary and fiscal policies that could stabilize these variables to make efficient portfolio performance of investors and best resource utilization. The evidence of the existence of the insignificant relationship between stock price index at DSE and exchange rate, inflation rate, interest rate, and money supply call for well-conceived policies that will help financial investors and agents focus on the role of these macroeconomic factors while deciding on resource allocation.
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADF</td>
<td>Augmented Dickey-Fuller</td>
</tr>
<tr>
<td>AIC</td>
<td>Akaike Information Criterion</td>
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<td>APT</td>
<td>Arbitrage Pricing Theory</td>
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<td>BIC</td>
<td>Bayesian Information Criterion</td>
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<td>CAPM</td>
<td>Capital Asset Pricing Model</td>
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<td>CPI</td>
<td>Consumer Price Index</td>
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<tr>
<td>DMC</td>
<td>Domestic Market Capitalization</td>
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<td>DSE</td>
<td>Dar Es Salaam Stock Exchange</td>
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<tr>
<td>DSEI</td>
<td>Dar es Salaam Stock Exchange Index</td>
</tr>
<tr>
<td>EUR</td>
<td>Europe</td>
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<tr>
<td>FPE</td>
<td>Final Prediction Error Criterion</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>HKD</td>
<td>Hong Kong Dollar</td>
</tr>
<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
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<tr>
<td>JPY</td>
<td>Japan Yen</td>
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<tr>
<td>LR</td>
<td>Likelihood Ratio</td>
</tr>
<tr>
<td>NSE</td>
<td>Nigeria Stock Exchange</td>
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<tr>
<td>RMB</td>
<td>Renminbi</td>
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<tr>
<td>SBIC</td>
<td>Scharz Bayesian Information Criterion</td>
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<td>SPI</td>
<td>SharePrice Index</td>
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<tr>
<td>TSI</td>
<td>Tanzania Share Index</td>
</tr>
<tr>
<td>U.S</td>
<td>United State</td>
</tr>
<tr>
<td>VAR</td>
<td>Vector Autoregressive</td>
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<tr>
<td>VECM</td>
<td>Vector Error Correction Model</td>
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<td>WPI</td>
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CHAPTER ONE

PROBLEM SETTING

1.1 Introduction
The stock market is a structured market whereby stocks, shares are being traded between buyers and sellers by way of stock exchange or over the counter. The listed shares of investors are being traded through a stock exchange and those unlisted shares are privately being traded through over the counter approach. As indicated by Hunjra, Chani, Irfan, Ijaz & Farooq (2014), macroeconomic factors comprises exchange rates, interest rates, inflation, and GDP which are very significant among the macroeconomic factors that affect the performance of the stock market.

The stock market plays a vital role in resource mobilization in developing and developed nations, resulting in the country's industrial and commercial growth. Macroeconomic factors have an important role in determining stock market operations and financial development for many countries in the world. The relationship existed between the macroeconomic factors and the stock price index has become an interesting topic in both developed and developing countries.

However, the results between macroeconomic factors and stock price index relationship are not constant overtime. Hence, this study investigated the relationship between the macroeconomic factors and the stock price index at Dar Es Salaam Stock Exchange (DSE) basing on the monthly time series data from 2012 to 2019.

1.2 Background of the study
The stock market is a regulated and standardized market of financial capital which is essential in an economical world whereby people, corporations, firms, companies, and governments either investing their funds or raising funds by using this formal financial system and organized capital market (Massele, Darroux, Jonathani, & Fengju, 2015).

According to Talla (2013), stock market acts as a transaction network where purchasers and sellers determine their prices and perform the financial exchange. In stock exchanges, the stock market offers long-term funds to firms and companies by
assembling funds from different investors which lets corporations develop their businesses as well as providing investors with different investment chances (Ullah, Islam, Alam, & Khan, 2017). Thus, this reveals that the stock market serves as an economic engine that organizes funds for corporate organizations and gives investment opportunities to individual, national, and international investors, with the target of maximizing their profits (Nijam, Ismail, & Musthafa, 2015).

In both developed and developing economies, stock markets depict the real picture of the financial strength of the country’s economy where forces from macroeconomic factors on the stock market returns (stock price index) are regularly assessed to guide investors and other players of the market appropriately (Omodero & Mlanga, 2019). Therefore, this shows that macroeconomic factors are very essential for any economic change in a country. Changes among these factors affect the economy in different ways, and that is why regulators of the economy are needed to take immediate measures to adjust their policies so that the economy continues to grow smoothly (Hunjra et. al., 2014).

In Africa, there has been a growth of the stock market since the 1990s compared to 1989 where there were only eight (8) stock exchanges on the entire African continent (Ihejirika, 2015). Presently, more than 50 percent of the 54 nations on the African continent have established stock exchanges. The rise in the stock exchange in Africa was a result of the development and modification of the business sector of African nations to develop the economic situation (Senbet & Otchere, 2008).

Despite the continent notable outstanding increased economic development since 2001 with annual average economic growth in the continent over 5% for the past 7 years, still, concerted efforts need to be in place to ensure the continent is lifted from lingering poverty, unemployment, and overall economic deterioration (Grace & Vardhan, 2016). To maintain the existing economic growth level and boost local and overseas investment on the African continent, Africa must quickly increase, develop, and modernize its stock markets to cope with the volatile macroeconomic factors overtime. Proof from current empirical studies showed that extensive stock markets can encourage economic growth and development (Grace & Vardhan, 2016).
Moreover, for African countries to achieve their targets in stock market operations, they should establish and develop supportive macroeconomic policies since among the factors hindering the stock exchange are unsupportive macroeconomic policies (Ihejirika, 2015).

In Tanzania, stock exchange activities are carried out by DSE. The DSE was started as a result of the government effort to transform the economy from a government-led economy to a private sector-led economy (Millinga & Raphael, 2018). According to DSE (2018), DSE PLC (Previous known as Dar es Salaam Stock Exchange Limited) is a guarantee limited liability company (joint venture) established under the Tanzania companies Act, 2002 in 1996. DSE officially started its operations in 1998 and on June 26, 2015, the registration of the company was changed from the status of a joint venture to shareholder ownership (Public Limited Company) where the name of DSE became DSE PLC. The Tanzanian stock exchange has become an essential project to increase the individual's income and companies.

However, as indicated by Viswanadham et al. (2014), the number of listed companies on the DSE is still very small in number far from the original expectations. Moreover, despite the government reforms and DSE establishment around the 1990s, the DSE is still a relatively new institution compared to stock exchanges in other parts of Africa as it failed to achieve an effective and efficient level in their financial activities.

In DSE there are fluctuations of returns of the stock market over years due to various economic reasons; for example, the statistics of annual financial statement reports of 2015 revealed the good financial performance of the DSE in the year 2014 to 2015. Moreover, the report indicated that in the fiscal year of 2014 to 2015, 1,942.85 million was made by DSE at the net surplus. This shows that in 2013/14 the amount was TZS 501.01 million which shows that DSE experienced a rise of 288 percent (DSE, 2015). These statistics reveal that there is no constant flow of stock returns and prices in the stock market overtime.
According to Millinga and Raphael (2018), some studies were conducted worldwide on the relationship between macroeconomic dynamics and stock market (stock return and stock price). These researches have shown different findings since these researches were carried out in different stock market behavior and used different macroeconomic factors. The researchers have reached a different size of the performance of the stock market, and the number of studies has shown that these stock market indicators are affected by the macroeconomic factors with regard to their intensity in various markets. Some theoretical reviews have been used by many studies to link changes in macroeconomic factors to stock prices (Millinga & Raphael, 2018).

These reviews contain the market hypothesis of semi-strong, Fisher effect theory, short interest theory, and the Arbitrage pricing theory (APT) which links macroeconomic variables to stock prices and stock market return (Grace & Vardhan, 2016). For instance; the connection between the macroeconomic setting and the stock market is analyzed from the asset pricing perspective where the theory arbitrage pricing (APT) is useful as a framework to express whether the risks related to certain macroeconomic variables are well reflected in the anticipated stock return (Ligocká, Pražák, & Stavárek, 2016).

The stock exchange is a vital portion of a country's economy, where all factors that affect its performance need to be properly evaluated (Kyangavo, 2016). However, the existence and volatility of macroeconomic factors give members of the stock market expectations of lower or higher returns in investing their stocks (Kirui, Wawire, & Onono, 2014). Changes in macroeconomic factors disrupt seriously the prices in the stock market index. These fluctuations of stock prices in the stock market draw attention to prospective investors, economists, and policymakers to study the relationship between these macroeconomic factors and stock prices in the stock market (Laichenya & Obwogi, 2015).

The relationship nature between macroeconomic factors and an index of stock prices and reviewed in numerous international stock markets revealed a significant negative and positive relationship for the similar factors in various stock markets (Abdalla,
For example; as indicated by Peiro (2016) who studied the relationship between macroeconomic factors and stock prices in European countries and compared his research results with the same research on the U.S.; the macroeconomic factors gave dissimilar effect to U.S. stock markets compared to those results on European nations for the time-period of 1969-2012.

Therefore, by studying the existing stock price index and macroeconomic factors relationship at DSE, can create a significant knowledge to policymakers, economists, investors, government, and other shareholders.

1.3 Statement of the problem

Stock exchange market and macroeconomic variables plays an important role in determining economic growth of a nation, it is an ideal tool for indicating sustainability and act as a measurement of national fiscal effectiveness, while giving a guiding principle for monetary policy execution, investment professionals and academicians. The mechanism of the stock exchange market involves various number of participants resulting an economy to be a very sensitive segments affected by several macroeconomic factors. The stock exchange market includes company ownership and funds, which is desirable to reflect the economic situation of a nation (Laurence, 2016) Overtime the rising stock price index indicates economic stability while the falling stock price index indicates instability. Most researchers agreed that the stock price index is affected by basic macroeconomic factors, such as inflation rate, interest rate, exchange rate and money supply (Duy, 2016).

According to DSE (2018), grounding on the performance of the stock exchange market, the year 2018 was a liquidity challenge year in the stock market as the value of transactions in DSE reduced by 60% from TZS 517 billion in 2017 to the transaction value of TZS 210 billion in 2018. The decline in the value of stock trading has affected DSE’s revenue, which accounted for 17% of DSE’s total revenue in 2018, compared with 33% in 2017. Therefore, the trend of DSE performance reveals that there were fluctuations in stock market returns in DSE starting from the year 2012 to 2019 which is being reflected by unstable stock price.
index trend. The fluctuations in stock market returns are results of different factors that affect the trend of the stock price index of the DSE.

In stock exchanges, the stock market offers long-term funds to firms and companies by assembling funds from different investors which lets corporations develop their businesses as well as providing investors with different investment chances (Ullah, Islam, Alam, & Khan, 2017). The falling and rising of the stock price index create unfriendly environment to the stock exchange market between buyers and sellers and this will have an effect in the country economy in totality when the situation is severe. When stock price index falls drastically due to fluctuation in macroeconomic factors result into market crash making mobilization of funds from corporations become difficult thus affecting profit of many companies. The situation further creates spill over effect to the economy such as lay off workers, decline in purchasing power of individuals or firms.

Since the economic meltdown in 2008, the stock market has grown into a hot topic argued by numerous scholars, investors and policy makers. Several studies were conducted to study the relationship between macroeconomic variables and stock price index. However, studies from various researchers come up with conflicting results on the relationship between macroeconomic variables and stock price index due to different methodology used, disparity in geographical location, differing period and different economy or capital market. Some studies revealed positive relationship, some findings show negative relationship and other results show insignificant relationship.

Gwahula (2018) conducted a study by assessing the macroeconomic variables in DSE using multiple regression model, the study revealed that interest rate had a negative relationship with Dar es salaam stock price index (DSEI) and inflation rate, exchange rate and money supply were insignificant to the DSEI. The same variables within DSE, Abdalla (2014) conducted a study on the relationship between macroeconomic variables on stock returns using VAR model come up with conclusion that inflation and exchange rate had a positive relationship with DSEI
while interest rate and money supply had a negative relationship with DSEI with significant effect of DSEI on exchange rate, interest rate and money supply.

Ibrahim and Aziz (2014) conducted a study on macroeconomic variables and the Malaysian equity market using VAR model, come with the results that money supply and exchange rate had a negative relationship with the stock price index. Bosupeng (2014) conducted a study in stock price index sensitivity to money supply using VECM model and come up with the results that money supply is positively related to stock prices.

Therefore, the inconsistence of results from various researchers on the relationship between macroeconomic variable and stock price index is what drives the need for a similar study to be conducted. Moreover, due to the current incidence in the world, the findings proposed by older scholars are not qualified to be used to the present economic state. This also reveals that examining stock price index with few macroeconomic factors over a certain time is hard to generalize the outcome. Thus to fill the existing gap the researcher used monthly time-series data (2012-2019) to investigate macroeconomic factors and stock price index (DSEI) relationship at DSE where four variables (Inflation rate, interest rate, exchange rate and money supply) were investigated.

1.4 General Objective
The research aimed to investigate the relationship between the macroeconomic factors and the stock price index at DSE.

1.4.1 Specific Objective
i. To examine the relationship between the inflation rate and stock price index at DSE
ii. To examine how interest rate relates to the stock price index at DSE
iii. To examine the relationship between exchange rate and stock price index at DSE
iv. To examine the relationship between money supply and stock price index at DSE
1.5 Research Questions
i. What is the relationship between the inflation rate and the stock price index at DSE?
ii. To what extent interest rate relates to the stock price index at DSE?
iii. What is the relationship between the exchange rate and stock price index at DSE?
iv. What is the relationship between money supply and stock price index at DSE?

1.6 Significance of the Study
Findings of this study can generate awareness among the investors, and other shareholders in DSE, whereby investors can understand how the interest rate, inflation rate, exchange rate, and money supply relate to the stock price index in DSE thus facilitate investment decision making process in the stock market.

Moreover, the findings of the study can generate knowledge and awareness to policymakers to formulate the supportive macroeconomic policies that can limit the fluctuations of macroeconomic factors. This can give confidence to the investors to have high optimism about the price situation and ultimate returns of their investment.

For other researchers, this research can form the basis of future research by forming a knowledge gap around the concept. In addition, current and future students can use research results and conclusions to enrich their knowledge of the subject, build their literature reviews and create new research fields related to the relationship between macroeconomic factors and stock price indices.

1.7 The Study Scope
The research concentrated on looking at the link between the stock price index and macroeconomic factors at DSE. The research studied four macroeconomic factors including interest rate, inflation rate, exchange rate, and money supply. Moreover, the study used time-series data on a monthly basis between 2012 and 2019 to study the relationship between the macroeconomic factors and stock price index at DSE.
1.8 Organization of the Study

This study is organized into six chapters with chapter one illustrates the background of the study, statement of the problem, research objectives, research questions, significance of the study, the scope of the study, and organization of the study. Chapter two covers a literature review which comprises theoretical and empirical reviews, whereas chapter three contains research methodology. Also, chapter four contains findings’ presentation whilst chapter five contains findings’ discussion, and chapter six includes findings’ summary, conclusions, recommendations, and further research areas.
CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction
This chapter contains the definition of key terms, theoretical reviews, empirical reviews, and the conceptual framework.

2.2 Definition of Key Terms
This part defines key terms that were used in the study including the term macroeconomic factors, stock market, interest rate, inflation, and stock price index.

• Macroeconomic Factors
Zarnowitz (2007) revealed that the key macroeconomic factors include the rate of inflation, rate of interest, as well as output, financial variables factors such as currency. As indicated by Hunjra et al. (2014), macroeconomic factors comprising exchange rates, interest rates, inflation, and GDP are very significant among the macroeconomic factors that affect the performance of the stock market. However, in this study, macroeconomic factors included interest rates, inflation rates, exchange rates, and money supply.

• Stock Market
According to DSE (2007), stock exchanges are secondary capital markets, whereby investors of all sizes can purchase and sell securities (such as stocks and bonds). This is a structured market in which securities purchasers and sellers meet under the representation of a broker/dealer to obtain securities. According to Hongbin (2007), the stock exchange refers to a market for financial transactions where members in the exchange can act as brokers or agents and dealers or traders. According to Nijam et al. (2015), the stock market serves as an economic engine that organizes funds for corporate organizations and gives investment opportunities to the individual, national, and international investors, with the target of maximizing their profits.
• **Interest Rate**
The rate of interest is the capital cost or returns demanded by the investors for the funds which were loaned within a specified period (Amata, Muturi, & Mbewa, 2016).

• **Exchange Rate**
The exchange rate is explained as the nation’s currency value expressed in another nation’s currency (Veli & Şeref, 2015).

• **Inflation Rate**
The inflation rate refers to the price increase measurement of service (product) over a time period in percentage. Inflation is described as the continuous rise in the overall price level of a nation’s general goods and services (Al Galib, Alam, Hossain, & Rahman, 2012).

• **Money Supply**
The money supply is expounded as the financial assets total amount in an economy in a given period (Barnor, 2014).

• **Stock Price Index**
Stock market price indexes are measurement overtime in the prices of stocks (or other financial assets such as bonds) traded in the particular stock market (Jazairi, 2014).

### 2.3 Theoretical Review

#### 2.3.1 Stock Prices and Macroeconomic Factors
Research on the relationship between the stock price index and macroeconomic factors has been so broad. However, the response of the stock market to macroeconomic factors varies by nation and period. Each macroeconomic factors affect the stock price index to varying degrees, and the degree of dependence varies over time. In this study macroeconomic factors including interest rate, inflation rate, exchange rate, and money supply are discussed.
2.3.1.1 Interest Rate

The rate of interest is the capital cost or returns demanded by the investors for the funds which were loaned within a specified period (Amata et al., 2016). Usually, the central bank uses interest rates as a monetary policy instrument to regulate the investment and supply of money. Amarasinghe (2015) pointed out that interest rate fluctuations have a significant negative effect on stock returns and stock price index. The rate of interest is equal to the borrowing cost. Thus, as the rate of interest increases, the costs of production rise at the same time, resulting in a decline in expected cash flows and stock price index.

Fluctuations in the rate of interest can bring effect at the stock price index in two ways: first, by affecting the discount rate that market members use to compute the existing value of the company's future cash flows; second, by affecting the prospects of future company performance. The first impact is due to changes in risk-free interest rates, which affect the company's demanded price, and the second impact is due to fluctuations in general economic factors and market borrowing costs. These fluctuations bring effect to the estimated flow of future cash, which market members use to estimate the existing company's value (Ioannidis & Kontonikas, 2008).

Moreover, analysing the impact of the announcements of interest rates on the stock market is complicated. The participants of the stock market may correctly expect fluctuation of interest rate and regulate their portfolios accordingly. If market members expect maximum interest rate fluctuations, announcements of interest rates will not provide new information. Thus, interest rate fluctuations should not have any major impact on the stock price index when there is a public announcement, which does not result in any significant abnormal returns. Likewise, if announcements of interest rate deviate from the expectation of the market, they give new information to market members and the interest rate should have a substantial effect on the stock price index (Schrey & Hafdisarson, 2017).

The rates of interest influence on the bond market directly. Though, the sensitivity of interest rates to the stock price index is not direct or constant. It is believed that the actual relationship between interest rates and stock price index is negative, that is,
rising interest rates cause the stock price index to fall (Reilly & Brown, 2011). However, this relationship is not continuously negative. The effect of the rate of interest on the stock price index fluctuates over time and also hinge on the business atmosphere (Park & Choi, 2011).

The interest rate is among the vital macroeconomic factors and is directly linked to economic development (Alam & Uddin, 2009). Commonly, the rate of interest is considered the capital cost, which refers to the price paid in the currency over a while. From the borrowers’ perspective, the rate of interest is the cost of borrowing. From the lenders’ perspective, the interest rate is the borrowing fee (the lender's interest rate). Virtuous investors are always looking for opportunities to invest in efficient markets. In an inefficient market, few individuals can yield unusual profit reasons, which causes the public to lose confidence in the market.

In this case, if the rate of interest from the bank pays to depositors increases, individuals will transfer their capital from the stock market to the bank. This will reduce the demand for stocks, lower the stock price index, and vice versa. Also, when the rate of interest paid by the bank to depositors rises, the lending interest rate will lead to a decrease in investment in the economy, which is another reason for the decline in stock prices, and vice versa. Therefore, ideally, there is an opposite link between the rate of interest and stock prices (Alam & Uddin, 2009).

When interest rates (the rate of return on government assets) rise and investors become more attractive to such interest rate rises, they may close the stock market position, causing the stock price to fall. Second, banks pay the public more deposit interest rates to compete with higher Treasury bills (Kasman, Vardar, & Tunç 2011).

Any increase in interest rate expenses seriously affects the profit of the firm and in turn, this results in negative perception to prospective investors. As a result, the need for investing in stock diminishes in the banking sector along with the decreases in their prices. Also, Moya-Martínez et al. (2015) indicated that businesses are profited by the reduction in the rate of interest. They also pointed out that the correlation between stock price and unstable interest rates can only be found in longer periods and certain industries.
Though numerous scholars believe that the rate of interest is an important factor in stock prices yet are not sufficient to predict stock market trends (Addo& Sunzuoye, 2013). As indicated by Naik and Padhi (2012), the rate of interest in the short-term failed to describe fluctuations in the stock price index. Also, the impact of interest rates on stock prices varies by industries, such as real estate stock performance, food, and beverage stock performance, utilities and banking stock. In contrast, the rate of interest has a limited impact on stock market trends in chemical, healthcare, construction, industrial and financial services (Moya-Martínez et al., 2015).

Furthermore, the rate of Treasury bill or interest on deposits is chosen as a measure of the rate of interest. The rate of interest formula is given by;

\[
\text{Interest rate (r)} = \frac{I}{P \times t}
\]

(1)

Where, I = Interest Amount, r = Rate of interest per year, t = time involved in months or years.

Chirchir (2014) came up with the conclusion that there is no significant causal relationship between stock price and interest rate, while Al-Tamimi et al. (2011) and Reilly and Brown (2011) indicated that interest rate had a significant negative relationship with stock prices. Therefore, based on these reviews the study develops the following hypothesis;

Null hypothesis (\(H_0\)): There is no significant relationship between interest rate and stock price index at DSE.

Alternative hypothesis (\(H_1\)): There is a significant relationship between interest rate and stock price index at DSE.
2.3.1.2 Exchange Rate

The exchange rate is explained as the nation’s currency value expressed in another nation’s currency (Veli & Şeref, 2015). As indicated by Veli and Şeref (2015), the value of the market and stock price index of a firm may be greatly affected by many factors, among which exchange rate fluctuations are important factors. Exchange rate fluctuations may determine the firm's stock price index.

When asset prices rise, local investors will invest more in the local market, thereby increasing demand for local currency and increasing sales of foreign assets, increased demand for local currency will force exchange rates to rise, which will eventually attract foreign investors to invest and get the most benefit. Thus, the local currency exchange rate will rise relative to the firm's exchange rate (Suriani, Kumar, Jamil, & Muneer, 2015).

As indicated by Suriani, Kumar, Jamil, and Muneer (2015), the value of the market and stock price of a corporation may be greatly affected by many factors, among which exchange rate fluctuations are an important factor. Although the topic has been extensively discussed, there is no consensus on the relationship between the stock market and the exchange rate. The financial theory explains that the value of a company must be affected by exchange rates. The fluctuations in the rate of exchange may determine the company's stock price index. Foreign direct investment is an important part of stock price index, and the decline or rise of the exchange rate may greatly affect the direction of foreign direct investment.

Likewise, the rate of exchange is correspondingly affected by fluctuations in stock prices. The link between the rate of exchange and the stock market may be different. It may hinge on changes in the economic situations, geographic area, relations with the international world, and local conditions. Due to trade volume, risk assessment, equity, economic relations, and other reasons, the results between different nations may be inconsistent. Since it can be one-way, two-way, or omnidirectional, it is impossible to estimate the impact of these two variables (Suriani et al., 2015).
According to Suriani et al., (2015), the connection between the rate of exchange and the stock market prices vary according to economic conditions, geographical area, association with the international nations, and local situations. Due to trade capacity, inventory and economic relations, risk assessment, and other reasons, the results may appear unpredictable among different nations. This shows that it is not an easy task to estimate the direction of influence of the two factors since it may be unidirectional, bidirectional, or omnidirectional.

The lower rate of exchange hinders exports, but imports are supported by lower economic activity and return on stocks. Therefore, research shows that the stock price index appears to be directly proportional to foreign exchange rates. Additionally, Bello (2013) measured the quoted exchange rate directly. For instance, when the foreign exchange rate (USD / EUR) drops, the local stock market (the United States) will also decrease. This reveals that the rate of exchange has a significant positive relationship with the local stock price index.

Furthermore, Jamil and Ullah (2013) indicated that the rate of exchange has a short-term effect on the returns stock market, the rise in the rate of exchange will drop the domestic currency and reduce the stock index return. Additionally, the rate of exchange rate must be maintained in a profitable area to stabilize the stock market. Therefore, it can be found that fluctuations in exchange rates negatively affect changes in the stock price index and ultimately stock market returns.

This research applied Tanzania Shilling to the United State Dollar exchange rate as a measure of the exchange rate and the formula for computing exchange rates is given as:

\[
\text{Exchange Rate} = \frac{\text{Starting Amount (Original Currency)}}{\text{Ending Amount (New Currency)}}
\] ................................................. (2)

Ibrahim and Aziz (2003) showed that the exchange rates had a negative relationship with the stock price index. However, results of the study by Suriani et al. (2015), and Rittenberg (1993), Muhammad, Rasheed, and Husain (2002), and Kemal, Haider, and Khalid (2004) indicated that there was no relationship between the exchange rate
and stock price. Therefore, based on these reviews the study develops the following hypothesis;

Null hypothesis ($H_0$): There is no significant relationship between exchange rate and stock price index at DSE.

Alternative hypothesis ($H_1$): There is a significant relationship between exchange rate and stock price index at DSE.

### 2.3.1.3 Inflation Rate

High inflation rates cause economic growth to collapse through various means, such as reducing the purchasing power of the country’s currency. Besides, the moderate inflation levels may have a bad impact on direct and indirect investment and national consumption decisions (Bai, 2014).

However, as indicated by Al Galib et al. (2012), lower inflation may result in a nation’s output or production losses, thereby increasing unemployment. Similarly, Frimpong and Oteng-Abayie (2010) found that inflation may encourage economic performance in the short term through macroeconomic policies; though, in the long run, inflation harm a nation's economic growth. In their research, they described that high inflation rates rise the social welfare cost and make mediation more expensive, thereby slowing financial development.

Limpanithiwat and Rungsombudpornkul (2010) noted that historically, stock prices are closely related to inflation. The research showed that stock prices increase according to the rate of inflation due to a positive relationship between them, but an indirect relationship. This shows that the rate of inflation can affect stock prices through the taxation of corporate income, cost reduction, and nominal capital gains tax. The rate of inflation may affect the business's performance and revenue, which indirectly affects its stock price. Besides, Ibrahim and Agbaje (2013) have demonstrated that inflation has a positive and important impact on the stock price index, and between them, there is a strong co-integration relationship. The research pointed out that inflation encourages investment flows and affects the direction of stock prices and stock returns.
If companies are net debtors, the unexpected rate of inflation increases the value of the company's shares, and because investors have less money to buy stocks, the decrease in inflation caused by the monetary policy will decrease the stock price index. Hence, both effects indicate a positive correlation between inflation and stock price index.

In contrast, Kimani and Mutuku (2013) showed that inflation is negatively related to stock prices. The study revealed that a high rate of inflation harms the overall performance of the stock market, including stock prices and stock returns. In a huge developing market, Ali (2011) suggested that high inflation rates would pressure companies or rise the nominal discount rate, which would lead to a decrease in the existing value of future earnings. Both effects will negatively affect company profits and reduce stock prices and stock returns.

In addition, Eita (2012) also indicated that higher inflation could lead to a forecasted future economic slowdown, which would lead to a drop in stock prices. Likewise, higher interest rates due to inflation will reduce the value of cash flows after discounting, thereby reducing investment, stock returns, and, ultimately, stock prices. Hence, the study founded that a higher rate of inflation is linked to lower stock prices, which is contrary to Fisher's assumption theory.

Interestingly, Ong et al. (2017) believe that inflation is negatively affected by stock price pressure, but not the other way around. In detail, research showed that inflation had no effect on stock prices, but higher stock prices can reduce the rate of inflation in one direction. Some studies summarize the effect of inflation on stock prices according to nations. Tripathi and Kumar (2014) exposed that inflation and stock prices have positive correlations in China and India, but there are negative correlations in Brazil and Russia. The effect of inflation has nothing to do with changes in stock prices, but it plays an important role in the overall economy.

The rate of inflation can be measured in different means such as the consumer price index (CPI), service price index (SPI), and wholesale price index (WPI) where the CPI compares the basket price of goods and services with the price of the base year. CPI is regularly the chief indicator used by different nations to measure the inflation.
rate, which can better represent the overall price level. The CPI is an effective indicator of the inflation rate calculation. It uses changes in the consumption of goods and services over a given period, and the main reason for generating a nominal interest rate to reduce the existing value of expected future cash flows. Therefore, the study used CPI to measure the rate of inflation for five years.

The formula for computing the Inflation rate is given as:

\[
\text{Inflation rate} = \frac{\text{CPI}_{x+1} - \text{CPI}_x}{\text{CPI}_x}\approx\frac{\text{Ending CPI level} - \text{Beginning CPI level}}{\text{Beginning CPI level}}\tag{3}
\]

Where CPI\(_x\) = Initial consumer price index

Or

\[
\text{Inflation rate} = \frac{\text{Ending CPI level} - \text{Beginning CPI level}}{\text{Beginning CPI level}}\tag{4}
\]

Where CPI = Consumer Price Index

Studies by Gwahula (2018); Al-Tamimi et al. (2011), and Talla (2013) indicated that the inflation rate had a significant negative relationship with the stock prices index. Their findings contrast Chakravarty and Mitra (2013), Abdalla (2014), and Hartmann and Pierdzioch (2006) who revealed that the inflation rate had a positive relationship with the stock prices index. Therefore, inbuilding foundation on these reviews the study come up with the following hypothesis;

Null hypothesis (H\(_0\)): There is no significant relationship between inflation rate and stock price index at DSE.

Alternative hypothesis (H\(_1\)): There is a significant relationship between inflation rate and stock price index at DSE.

2.3.1.4 Money Supply

The fluctuations of the money supply are good indicators and a significant source of business information about the future stock market or fluctuations in prices (Barnor, 2014). A money supply increase in a country improves economic growth, and stock prices as it benefits from the policy of expansionary monetary. In other words, as the
money supply rises, liquidity accessibility will rise at a lower interest rate, which moves to the stock market (Rahman, Sidek, & Tafri, 2009).

It is commonly assumed that expansionary monetary policy and restrictive monetary policy led to an increase in share prices and a decrease in share prices, respectively. Also, as some scholars designated, variations in monetary policy can affect the capital cost and stock prices. The simple logic is that higher interest rates due to restrictive monetary policies can force investors to raise funds through stock prices. In addition to increasing demand for stocks, prices will drop at least to a level that attracts investors in the short term (Rifat, 2015).

The monetary policy aim is to find the right mix of different macroeconomic variables, which will achieve optimal economic growth through different macroeconomic variables. Currency is among the most vital tools of the Central Bank to control and promote economic activities. Whether the monetary policy is expansionary or restrictive depends on the economic and current market conditions of that particular economy. Smaller changes in monetary policy will affect stock prices in the financial markets at a faster rate and on a larger scale. However, all markets interact differently in speed and intensity. That is why it is significant to comprehend the monetary policy impact on the prices of different assets because these assets will ultimately lead to economic growth (Mahzabeen, 2016).

As indicated by Sirucek (2013), in the long run, the most significant factor affecting the stock prices progress is the money amount in the economy, because when the amount of money in the economy exceeds the available amount, the money supply directly affects the stock price index.

The rise in the supply of money is generally considered to have a positive effect on the stock price index. As the money stock rises, it encourages the growth of the economy, thereby increasing the firm’s credit for expanding production, and then increasing sales and the firm’s profits. This leads to a better payment of dividends, which leads to higher stock prices, though the supply of money may be inversely (negative) related to stock prices (Talla, 2013).
The circulation of money in a particular economy has a positive correlation with the return on stock return and stock price index. Consequently, a rise in the supply of money in the economy stimulates purchasing power, thus becoming a direct mechanism for stimulating production and consumption, thereby making corporate profits and savings. The investors will direct more money to buy stocks in anticipation of an increase in stock dividends due to the rise in expected future cash flows. The rise in profit and propensity to save results in increased liquidity (Ozbay, 2009).

As indicated by Ozbay (2009), fiscal policy affects the entire economy through a diffusion mechanism. The expansionary monetary and obstructive monetary policy may have two-sided effects on the economy. Thus, through the expansionary monetary policy, the government increase more liquidity by participating in operations of an open market, which leads to higher prices of bond and thus increasing the stock price index.

Likewise, the rise in the supply of money shows an increase in the liquidity level available for the purchase of stocks, which ultimately leads to an increase in stock prices due to the increased demand for common stocks and actual commodity markets. Nevertheless, relying on Fisher's equation, an increase in the money supply may lead to higher inflation, which in turn leads to higher nominal interest rates. Higher rate of interest results in a higher required return rate, which results in lower stock prices (Ozbay, 2009).

Abdalla (2014), in Tanzania, the Central Bank described three money levels including: First, narrow currency (M1); which involves the circulation of currency outside the banking system adding to demand deposits accounts or cheque accounts; Second, includes broad money (M2) adding to fixed and savings deposits; Third, extended broad money (M3) comprises of (M2) adding to foreign currency deposits of residents. The money supply factor is used in broad money (M2), and its calculation formula is:

\[ MS = \ln \left( \frac{M_{2t}}{M_{2t-1}} \right) \]

..................................................................................................................(5)
Therefore, the volume of Tanzania shilling was considered to be a measurement of the money supply in the economy (M2).

The study by Ibrahim and Aziz (2003) showed that the money supply had a negative relationship with the stock price index, which is different from the results by Bosupeng (2014) who found that money supply is positively related to the stock price index. Also, the stock price index responds positively to M2 which is well-matched with the result of Muro and Puentes (2004), and (Sellin, 2001). Therefore, in building foundation on these reviews the study come up with the following hypothesis;

Null hypothesis ($H_0$): There is no significant relationship between money supply and stock price index at DSE.

Alternative hypothesis ($H_1$): There is a significant relationship between money supply and stock price index at DSE.

2.3.2 Theories of the study
The study applied theories such as Arbitrage Pricing Theory, Efficient Market Hypothesis, and Fisher Effect Theory to show the relationship between macroeconomic factors and stock price index.

2.3.2.1 Arbitrage Pricing Theory (APT)
APT was initially proposed by Stephen Ross in 1976. He tried to demonstrate that any stock return is linearly related to a series of organized factors and risk-free rates (Jianu, GEAMBAŞU, & Herteli, 2014). Omodero and Mlanga (2019) indicated that in APT, the anticipated stock return might be described in two means; First, the effect of specific macroeconomic or security factors, and the asset sensitivity of these effects. APT displayed that overall risks can be mitigated through a large and expanded investment portfolio. Though, because the common economic factors affect the whole stock price in the market, it cannot be eradicated, which also means it cannot be resolved through diversification. Arbitrageurs regularly use the model of APT to find arbitrage opportunities. In this case, the price of assets will be not the same as the hypothetical price derived from the model. The equation (6) shows the
risk-free rate linear combination and the organized risk-return (Shaji & George, 2012).

\[ E(r_j) = RFR + a_1RP_1 + a_2RP_2 + a_3RP_3 + \ldots + a_nRP_n + \varepsilon_j \] .......................... (6)

Where;

RFR = Risk-Free Rate, RP = Risk Premium for a specific factor, aj = Asset’s return sensitivity to particular factor, \( \varepsilon_j \) = error-term, \( E(r_j) \) = Asset’s expected rate of return

As indicated by Shaji and George (2012), APT is generally viewed as a substitute for the Capital Asset Pricing Model (CAPM). However, APT is stronger than CAPM since the assumptions of APT are less strict than CAPM. Moreover, the APT takes into account multiple and single-period at the same time, while the CAPM considers only a single-period. Though CAPM contains a well short-term stock price prediction, compared to CAPM, the APT medium and long-term results are more accurate. This has made APT acknowledged by investors and scholars.

According to Abdalla (2014), early research used APT to measure the risk premium for asset returns and explain the importance of macroeconomic factors affecting market stock prices and returns. The APT model assumes that changes in macroeconomic factors affect the stock market, as Rashid (2007) found that increasing real interest rates would reduce the existing future cash flowincorporation and cause the stock price to drop.

Furthermore, Kandir (2008) noted that risk factors in the APT model are the result of changes in macroeconomic factors (such as fluctuations in interest rates, actual business activities, inflation rates, and exchange rate). The multi-factor APT model underpins the return of assets and stock prices. Therefore, this theory is relevant to this study as it demonstrates that the price and return of any stock are linearly linked to a series of organized factors such as macroeconomic factors and risk-free rates. Moreover, APT indicates the temporary incorrectness of market stock price so that immediate actions can be taken to engulf the situation by bringing back the deviated price of the stocks.
2.3.2.2 The Efficient Market Hypothesis

The efficient market hypothesis was developed by “Eugene Fama” who first used the term "efficient market" (Fama, 1970). Fama (1970) described an efficient market as a market where stock prices continuously reflect all available information. Toniok (2017) pointed out that the efficient market hypothesis has three forms, including weak, semi-strong, and strong form. The weak form performance depends on the premise of random walk that future price fluctuations are independent of previous price changes. Likewise, when the information set is publicly available information, the efficiency of the semi-powerful model will be displayed, and when the information set is all information including internal information, the efficiency strong form can be displayed (Osei, 2002).

The research established that form of semi-strong is the most appropriate since the stock prices in this market reflect all the information available to the public. This is why there are stock price fluctuations since all macroeconomic factors that affect a business’s stock should be assessed to determine its stock price in an almost robust manner under the semi-strong market environments.

Information about macroeconomic factors is generally provided to the public through publications by the International Monetary Fund (IMF), World Bank, and central banks around the world (Talla, 2013). Thus, since one and all know industry-related information, it is easy to monitor companies operating in a specific industry, and the stock price cannot be exaggerated to obtain profits. More importantly, investors usually make wise and prudent investment decisions to be free from investment losses due to a lack of information.

Business performance is reflected in the stock price where market efficiency can also ensure effective resource allocation, which can allow potential investors to understand when to make the best investment decision (Mensah, Adom, & Pomaa-Berko, 2014). Therefore, positive or negative fluctuations in the business's future cash flow will have a positive or negative effect on the stock price since investors will purchase or sell stocks (Schöler, Skiera, & Tellis, 2014). This also shows that
when new information about inflation is announced to the public, the market will quickly absorb new information about inflation, which will affect stock prices.

2.3.2.3 Fisher’s Effect Theory
Fisher (1930) proposed the theory of the Fisher effect where the premise of this theory is that the nominal interest rate completely reflects the available information about inflation expectations. The Theory of the Fisher effect is the foundation of the monetary policy which should focus mostly on managing inflation expectations to stabilize the interest rate which may affect the stock price. This intends to promote savings and investment (Laichena & Obwogi, 2015).

The fisher-effect theory also pointed out that the expected return rate of common stocks includes the actual rate of return and the expected inflation rate. It is assumed that the actual return of the common stock is persistent over time. Assuming that negative returns will just exceed positive actual returns, the interest rate of common stocks is anticipated to move in proportion to the inflation rate (Mahonye & Mandishara, 2014).

The Theory of the Fisher effect assumes that the nominal interest rate of financial assets should move one-to-one with the expected inflation rate. Moreover, short-term and long-term fluctuations in the rate of interest are anticipated to affect the discount rate in the same way through the impact on nominal risk-free rates (Kuwornu, 2012). The theory of the Fisher effect assumed that the actual interest rate and monetary sector have no relationship (Floros, 2004).

Moreover, the Fisher hypothesis suggested that stock prices and returns should be free from inflation (Shanmugam & Misra, 2008). Commonly, Fisher's theory assumes that the nominal return rate on financial assets should rise with the inflation rate, while the actual return rate has nothing to do with the inflation rate. Accordingly, the theory of the Fisher effect applied to stock returns is premised on the inverse relationship between stock prices unpredictable inflation.
2.4 Empirical Reviews
The study has applied for different reviews from both within and outside Tanzania to understand how other scholars have written about the relationship between the stock price index and macroeconomic factors to compare and contrast their methodologies and findings from this study as well as strengthening the discussion of findings of the study.

2.4.1 Interest Rate Vs Stock Price Index
Amarasinghe (2015), applied monthly data from January 2007 to 2013, December to research the causal link amongst stock price index and the rate of interest. The stock price index of the Colombo Stock Exchange was used. Interest rates are collected from data from the Sri Lanka Central Bank. The Augmented Dickey-Fuller test was useful to find the existence of the unit root problem, and the test results show that the stock price index and the interest rate were stationary for the first difference. The test of Granger causality was useful to test the causal link between the stock price index and interest rates, and the results show that there is a unidirectional link between the variables. In other words, equity returns will not result in Granger's interest rates, but interest rates will cause Grangers' equity returns. Finally, to verify the results of the Granger Causality Test, a regression analysis was performed. Regression output depicted that the rate of interest was a vital factor in fluctuations in the stock price index and that the rate of interest is negatively linked with the stock price index.

As indicated by Alam and Uddin (2009), to aid an active stock market grounded on monthly data from January 1988 to March 2003, and the stock indexes of 15 developed and developing nations (Australia, Canada, and Bangladesh) also displayed an empirical relationship with interest rates. Germany, Chile, Colombia, Italy, Mexico, Jamaica, Japan, Malaysia, the Philippines, and Venezuela, South Africa, and Spain. Tested the stability of market returns and found that no stock market follows the random walk model, which means that efficiency is not weak. To inspect the causes for market inefficiency, the link between the stock price index and interest rates, are determined by the time series and slope of the board. For all nations, the interest rate has a significant negative correlation with the index. It is
found that there are significant negative correlations between interest rate and stock price index changes in six countries. Hence, if interest rates in these nations are practicable to some extent, then this will benefit the stock exchanges of these countries by increasing the demand for more investors in the stock market and expanding the investment offers of more companies, prominent.

Kyangavo (2016) investigated macroeconomic variables effect including real GDP, exchange rate, and the interest rate on listed commercial bank’s price index in Nairobi stock exchange between January 2000 and December 2013 on time-series data that were taken in quarterly. The research applied the test of Johansen co-integration, Causality, VECM which were analysed through E-views. Results exposed that there was a significant positive long relationship between exchange and interest rate with the stock price index through co-integration. The results of VECM exposed that the stock price index has a short-run relationship with the exchange rate and real interest rate.

In Swiss real estate companies, Ligocká, Pražák, and Stavárek (2016) examined the macroeconomic factors impact on the stock prices. The research used price level, GDP, and interest rate as macroeconomic variables to check their impact on stock prices. Johnson's co-integration was a useful test used to examine the long-term equilibrium relationship between these macroeconomic variables (money supply, interest rate, exchange rate, inflation rate), and stock prices. Besides, the relationship of short-run equilibrium was examined through the VECM and the test of Granger causality.

Findings exposed that in the period between 2005 to 2014 there was a long-run equilibrium relationship of five stocks among the six stocks studied. On the other hand, the study confirmed that macroeconomic factors such as interest rate can reveal the stock price behaviour in the long-run. In contrast, in the short-run, there was no significant impact of interest rate on stock prices. However, study findings vary widely among the stocks, so they prevent this study from drawing overall conclusions about the entire Swiss real estate sector.
2.4.2 Inflation Rate Vs Stock Price Index

The study by Gwahula (2018) aimed to determine the development of influencing factors at DSE. The study applied four factors including rate of exchange, the rate of inflation, money supply, and rate of interest to achieve the objective goals. The positivism method was applied by the research followed by the method of quantitative analysis of variables using multiple regression models to link the macroeconomic factors to the stock performance at DSE.

The research results exposed that the interest rate has a negative correlation with the DSE Stock Index. The inflation rate, money supply, and exchange rate were not statistically significant, which explains the volatile of DSE. The research recommended that the Tanzanian government must appropriately manage macroeconomic policies so that investors develop confidence and attract new investors.

As indicated by Akani (2013) in Nigeria, did the relationship between macroeconomic factors, including the inflation rate, money supply, interest rate, and total stock price. The survey results by using the test of Granger Causality and Johnson's co-integration in VECM exposed that fluctuations in the selected macroeconomic factors had a significant influence on the total stock price during the study period. Grounded in this research, there was a long-run negative relationship between the inflation rate and the total stock price, and it has been found unidirectional connection from inflation to the total stock price. Correspondingly, money supply and total share price had significant bidirectional causality with a positive relationship.

Talla (2013) studied the impact of fluctuations in selected macroeconomic variables on stock prices at the Stockholm Stock Exchange. The paper applied a test of unit root or stationarity, the test of Granger causality, and multiple regression models to get an estimation of the relationship of these variables. The research applied the time series of monthly data from 1993 to 2012. Based on estimated t-statistics and regression coefficients, it turns out that the rate of inflation and depreciation of currency had a significant negative effect on stock prices.
Also, the rate of interest was negatively correlated with the fluctuations in stock price but has no significance in the model. Furthermore, the study findings exposed that even though the money supply had no significant impact on the model, it was still positively related to stock prices. Results also exposed that no unidirectional relationship was found in Granger causality among all variables except for the stock price to inflation.

Bredin, Hyde, Nitzsche, and O’reilly (2009) in six stock markets, Canada, France, Germany, Japan, U.K., and the U.S revealed that inflation provides little or no explanatory power in explaining stock returns. The hypothesis of the fisher is consistent with the prevailing result and compatible with the result of most past researches, especially, those conducted at the emerged stock market.

2.4.3 Exchange Rate Vs Stock Price Index

John and Kisava (2018) researched on a link between different stock prices and the exchange rate (Tanzanian shilling (TZS) per dollar exchange rate (USD)) in DSE. The study applied day-to-day data sets covering six years from August 15, 2011, to July 28, 2017, to provide 1,455 observations. The Vector Autoregressive model (VAR) followed by Granger causality and other several tests were used to achieve the desired results in the study. The study concluded that there was a short-term relationship between exchange rate and stock price. The information that exchange rate shocks do not affect stock prices supports these results. This may mean that at DSE investors can make short-term investments.

Suriani et al. (2015) examined the exchange rate impact on the stock market. The research investigated the relationship between the stock market and the exchange rate in Pakistan. The KSE-100 index as a proxy of the stock price and the currency exchange rate of 100 rupees to the US dollar (rupee/dollar) was used as the exchange rate. Data were provided monthly and the time-period was from January 2004 to December 2009. The research used tests of Augmented Dickie Fuller and causal Granger to test stationarity or unit root of the financial factors whether they were affected by each other or different. The research findings exposed that the exchange
rate had no significant relationship on the stock price, and the two factors were independent of each other.

Abdalla (2014) did research on the relationship between returns of the stock market and macroeconomic factors at the DSE. From 2002 to 2013, 144 months of observations were analyzed in a scientific way using econometrics and financial models, taking into account the experience of previous reviews of researchers. The Augmented Dickey Fuller and Phillip Peron tests were useful to check if the unit root corresponds to time series data, then performed the Granger Causality Test to test causality between variables. The model of VAR was used to assess the statistically significant relationship between returns and macroeconomic variables which were a part of defining the sign and extent of a relationship's effect.

The findings exposed that the index of DSE had a positive reaction to the inflation and the exchange rate, but a negative reaction to the interest rate and money supply. The model of VAR displayed a great influence on exchange rates, interest rates, and money supply and in contrast to the weak effects associated with variables of the inflation rate.

Makuand Atanda (2010) studied the long-term role of the rate of exchange rates in describing Nigerian returns on the stock. The research exposed that the share index of Nigeria Stock Exchange (NSE) made a co-integration relationship with long-term exchange rate changes. Onasanya and Ayoola (2012) also supported this, stating that exchange rates have long-term and short-term effects on the Nigerian stock price index. The research also showed that the rate of exchange is unidirectional and statistically correlated with average stock market performance negatively. This means that only an increase in the average share price will cause changes in the exchange rates.

As Suriani et al. (2015) pointed out, the rate of exchange and stock markets are the world's two main financial markets. The two markets play a major role in global international business. It is necessary to understand the relationship between the two markets so that investors can invest better by taking minimal risks. This article examines the relationship between the Pakistani stock market and the exchange
market. The KSE-100 index replaces the stock price, and the currency exchange rate of one hundred rupees to the US dollar (Rupee / USD) is used as the exchange rate offer. The data are monthly data, and the time period is from January 2004 to December 2009. The result of the survey depicted that there is no link between the rate of the exchange and the stock price and rate of the exchange and the stock price is independent of each other.

As indicated by Singh (2010) and Zubair (2013) found that there is no relationship between the rate of exchange and the index of the stock market. This showed that the rate of exchange has no impact on stock prices. Zia and Rahman (2011) provide support for this. Likewise, as indicated by Kutty (2010) stock price results in short-term exchange rates, but there is no long-term relationship between the two fiscal factors. There is a non-existent connection between the two variables. Moreover, the research exposed that the index of stock price fluctuates both in the long-term and in the short-term, and it is impossible to predict the trend of the stock market through the exchange rate.

**2.4 Money Supply Vs Stock Price Index**

The research by Humpe and Macmillan (2007) in Japanese indicated that stock prices were negatively affected by the supply of money, while the relationship between US stock prices and the money supply was not statistically significant (though positive). Results of researches from developing markets were contradictory. For instance, the research by Maghayereh (2002) at Amman Stock Exchange indicated that the money supply coefficient (M1) was negative, but it was insignificant at the level of 10 percent, whilst Al-Sharkas (2004) displayed that the money supply (M2) affect stock returns positively.

Maysami, Loo, and Koh (2004) exposed a positive relationship between fluctuations in money supply (M2) and return on Singapore stocks. In Brazil and Argentina as claimed by Abugri (2008), the supply of money was significant and negative related to stock prices, whilst in Mexico and Chile, the money supply did not seem significant in explaining fluctuations in stock prices. As indicated by Nishat, Shaheen, and Hijazi (2004) the supply of money (M1) and index stock exchange at
Karachi were co-integrated, and between these factors, two long-term equilibrium relations existed.

Sahu and Pandey (2020) attempted to use a time-variable parameter model with a self-declining index heading to understand the effect of money supply changes as an important influence of monetary policy on Indian stock prices and to conduct a broad understanding and existing literature. The Johansen co-integration test results depict that there is a significant positive long-term synergy between India's money supply growth and stock prices, but the results of the vector error correction model (VECM) have not shown any significant long-term effects. Short term relationship. In addition, the VECM error correction term shows a one-way long-term causal relationship from money supply to stock prices.

However, the Granger Causality Test confirms that the money supply growth rate will not cause volatility in the Indian stock market in the short term. Finally, an analysis of variance analysis shows that the Indian stock markets are strong external, meaning that the effect of the money supply explains only a small portion of the expected variance error of the market index. Third, the analysis of the driving response function shows that the positive shock of the money supply has had a small but persistent positive impact on Indian stock prices.

Khan and Khan (2018) analyzed the monthly data from May 2000 to August 2016 to examine the impact of different macroeconomic variables on the stock price of the Karachi Stock Exchange in Pakistan. Since there was stationarity of all variables at the first difference, then the ideal ARDL method is suitable for testing both the short-term and long-term relationship (co-integration) of macroeconomic factors on stock prices.

Findings exposed that the long-term stock price of Karachi Stock Exchange is highly affected by the money supply, interest rate, and exchange rate. In the short term, results revealed exclude exchange rate which was negative co-integrated with stock prices, all remaining variables were not statistically significant. The research suggested that the central bank must remain cautious when changing the supply of money in the stock market because a large increase in the supply of money will
affect the stock market and investment. Regulators must retain interest rates low to boost the external economic environment as well as economic activities.

2.5 Research Gap
The Arbitrage Pricing Theory, Efficient Market Hypothesis, and Fisher Effect Theory speculate that there is a link between macroeconomic factors and the stock price index, however, these theories do not specify the kind or number of macroeconomic factors that must be included. Also, the empirical studies show that a large number of macroeconomic factors were used to test their effect on stock returns, and few studies were carried out on the relationship between macroeconomic factors and stock price index in Tanzania (for instance, John & Kisava, 2018), Epaphra, (2018). Furthermore, the results in the reviews of the literature are mixed because the literature is sensitive to nation selection, factors choice, and the time where the study was carried out. Since each market has a unique character such as rules, investors type, regulations, then it is hard to generalize the findings.

The Vector Error Correction Model (VECM) technique, Vector Auto-Regression (VAR), the Granger causality test, Co-integration, and the GARCH model are generally used to check the relationship between the stock price index and macroeconomic factors, but, there is no clear evidence for choosing the correct model. Furthermore, it is clear that there is insufficient literature in the emerging stock markets, but especially in the Tanzanian market. Based on Tanzania, among the studies reviewed, there are insufficient studies on the relationship between macroeconomic factors and stock price index (2015-2019). In addition, most of the studies are out-of-date because of the current economic events, hence, this necessitates the study on the relationship between macroeconomic variables and stock price index at DSE to be conceived.

2.6 Conceptual Framework
The conceptual framework in Figure 2.1, illustrates the pictorial relationship between the macroeconomic factors and the stock price index. In this study, macroeconomic factors (Interest rate, Exchange rate, Inflation rate, and Money supply) are the independent variables while the stock price index is the dependent variable.
Figure 2.1: Conceptual Framework

Independent Variables

- **Interest rate**
  - Interest on deposit/Treasury bills

- **Exchange rate**
  - Tanzania shilling per USD

- **Inflation rate**
  - Consumer price Index (CPI)

- **Money supply**
  - Volume of Tanzania shillings in the economy (M2)

**Stock Price Index**

- Average stock Price (DSEI)

**Source:** Researcher’s work
CHAPTER THREE

RESEARCH METHODOLOGY

1.3 Introduction

The core parts of this chapter contain study design, area, sampling approaches, and sample size, data sources and types, procedures of data analysis.

3.2 Research Design

The causal study design was useful to study the macroeconomic factors and stock price index relationship at DSE. The causal research design was selected to determine the degree and nature of causality, that is to say, it was selected to investigate the impact of specific changes on current principles, different processes, and behaviours. The study used a causal research design to explore the influence of a variable (macroeconomic factors) on another variable (stock price index) (Oppewal, 2010).

3.3 Study Area

The research was carried out at Dar es Salaam Stock Exchange (DSE). DSE was started as a result of the government’s policy efforts to transform the economy from a government-led economy to a private sector-led economy (Millinga & Raphael, 2018). According to DSE (2018), DSE PLC (Previous recognised as Dar es Salaam Stock Exchange Limited) is a guarantee limited liability company (joint venture) established under the Tanzania companies Act, 2002 in 1996. DSE officially started its operations in 1998 and on June 26, 2015, the registration of the company was changed from the status of a joint venture to shareholder ownership (Public Limited Company) where the name of DSE became DSE PLC. To accomplish the study, the monthly data of the stock price index (DSEI) for the last eight years (2012-2019) was taken from DSE.

3.4 Data Sources

The research included secondary information. The secondary data in this study was obtained through published and unpublished materials such as journals, books, magazines, and different reports. The information on the stock price index (DSEI) from 2012-2019 was obtained from the DSE database. The data for the exchange rate,
inflation rate, interest rate, and money supply was obtained from the Bank of Tanzania, database. Figure 3.1. 3.2, 3.3, 3.4, and 3.5 indicates the trend of data of stock price index (DSEI), exchange rate, inflation rate, interest rate, and money supply from 2012-2019.

3.4.1 Stock Price Index (DSEI)
Findings in Figure 3.1 indicate fluctuations in stock price index (DSEI) in the respective years.

**Figure 3.1: Trend of the Stock Price index (DSEI, 2012-2019)**

![Graph showing trend of the Stock Price index (DSEI, 2012-2019)](image)

**Source: Researcher (2020)**

Findings in Figure 3.1 shows the monthly trend of the stock price from 2012 to 2019 wherefrom 2012, findings reveal that there was a rise in stock prices. Moreover, the trend depicts that the DSE experienced the highest stock price index in the market in July 2016. Generally, from 2012 to 2019 the DSE experienced a fall and rise of DSEI in the market in the respective years.
3.4.2 Exchange Rate

Findings in Figure 3.2 indicates fluctuations in the exchange rate in the respective years.

Figure 3.2: Trend of the Exchange Rate (2012-2019)

Source: Researcher (2020)

Findings in Figure 3.2 show the monthly trend of exchange rates from 2012 to 2019 wherefrom 2012, findings reveal that there was a gradual rise in exchange rates. Moreover, the trend depicts that the DSE experienced the highest exchange rates in the market in March 2019. Generally, from 2012 to 2019 the DSE experienced an increase in exchange rates in the market in the respective years. Economically, the increase in exchange rates relative to other nations (in USD) increases exports and discourage imports. Thus, in these respective years, the country created a conducive atmosphere for exports rather than imports. The high exchange rate may result in
stock price to rise and this indicates that the future inflation rate will decrease, causing investors to hope the stock market's future performance.

**3.4.3 Inflation Rate**

Findings in Figure 3.3 indicates fluctuations in the inflation rate in the respective years.

**Figure 3.3: Trend of Inflation Rate (2012-2019)**

![Graph showing trend of inflation rate from 2012 to 2019](image)

**Source: Researcher (2020)**

Findings in Figure 3.3 show the monthly trend of inflation rates from 2012 to 2019 wherefrom 2012, findings reveal that exchange rates were dropping up to March and February 2019, and after that, the trend of inflation rate started to rise. The effect of dropping on inflation rates on the stock market can be observed through the rise in stock index in these respective years where the stock price was increasing with the decrease in the inflation rate. The increase in the inflation rate over time implies that
the purchasing power gets worsens at the early stage of the economy which discourages the marginal propensity to save and invest.

3.4.5 Interest Rate

Findings in Figure 3.4 indicates fluctuations in the interest rate in the respective years.

**Figure 3.4: Trend of Interest Rate (2012-2019)**

Source: Researcher (2020)

Findings in Figure 3.4show the monthly trend of interest rates from 2012 to 2019 wherefrom 2012 to 2019 findings reveal that there were a rise and fall of interest rates. Moreover, the trend depicts that the DSE experienced the highest interest rates in January 2016 and the lowest rate in April 2018 in the market. When interest rates rise, both firms and consumers cut spending. This may lead to a decrease in profits and a decline in stock prices. Also, when interest rates fall sharply, consumers and businesses will increase spending, causing stock prices to rise.
3.4.6 Money Supply

Findings in Figure 3.5 indicate fluctuations in the money supply in the respective years.

Figure 3.5: Trend of Money Supply (2012-2019)

Source: Researcher (2020)

Findings in Figure 3.5 show the monthly trend of the money supply from 2012 to 2019 wherefrom 2012 to 2019 findings reveal that there was a rise and fall of the money supply. Moreover, the trend depicts that the DSE experienced the highest money supply in September 2013 and money in February 2017 in the market. The effect of money supply on stock price index can be observed when the money supply increases or decreases in the economy.

3.5 Variables and Measurement

In this study, independent variables comprise the exchange rate, inflation rate, interest rate, and money supply while the dependent variable includes the stock price
index. Table 3.1 indicates variables (independent and dependent variable) and measurement of variables.

Table 3.1: Indicators and Measurement of Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent variables</strong></td>
<td></td>
</tr>
<tr>
<td>Interest rate</td>
<td>Treasury bills rate or Interest on deposit</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>Tanzania shillings per USD</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>Consumer Price Index (CPI)</td>
</tr>
<tr>
<td>Money supply</td>
<td>The volume of Tanzania shillings in the economy (M2)</td>
</tr>
<tr>
<td><strong>Dependent variable</strong></td>
<td></td>
</tr>
<tr>
<td>Stock price index</td>
<td>Average stock Price index (DSEI)</td>
</tr>
</tbody>
</table>

Source: Researcher, 2020

3.6 Specification of the Model

The research adopts the Arbitrage Pricing Theory, Fisher Effect and Efficient Market Hypothesis model to illustrate the stock price index and macroeconomic factors relationship.

Stock price index = f (macroeconomic factors)

Therefore, the multivariate regression model of the study is expressed as:

\[ \lnSPI = \beta_0 + \beta_1(\lnIR_t) + \beta_2(\lnEXR_t) + \beta_3(\lnINFR_t) + \beta_4(\lnM_2t) + \varepsilon \]............................(6)

Where;

\( SPI_t \) = Stoke Price Index at time t  (Dependent Variable)
\( IR_t \) = Interest Rate at time t
\( EXR_t \) = Exchange Rate time t
\( INFR_t \) =Inflation Rate time t
\( M_2t \) = Money Supply time t
\( \beta_0 = \) Constant
\( \beta_1, \beta_2, \beta_3, \) and \( \beta_4 \) are coefficients of Interest Rate, Exchange Rate, Inflation Rate, and Money Supply respectively.

\( \varepsilon = \) Error term
In = Natural Logarithm

3.7 Time Series Model Selection

If Co-integration is not present, then VAR should be applied and If co-integration is present then VECM should be applied. Since in this study, variables are not co-integrated, then the VAR model is useful.

In this model, there is a short-run relationship since all variables are not co-integrated (co-integrated of order one) running from independent variables to the dependent variable. All variables in the VAR model are endogenous (determination of their values are based on the model). The study involved an unrestricted VAR model (short-run model) with the five variables including;

\[
(\text{Stock price index})_t = \alpha + \sum_{i=1}^{k} \beta_i (\text{Stock price index})_{t-i} + \sum_{j=1}^{k} \varphi_j (\text{Interest rate})_{t-j} + \sum_{m=1}^{k} \varphi_m (\text{Exchange rate})_{t-m} + \sum_{p=1}^{k} \psi_p (\text{Inflation rate})_{t-p} + \sum_{q=1}^{k} \gamma_q (\text{Money supply})_{t-q} + \mu_1
\]

\[
(\text{Interest rate})_t = \vartheta + \sum_{i=1}^{k} \beta_i (\text{Stock price index})_{t-i} + \sum_{j=1}^{k} \varphi_j (\text{Interest rate})_{t-j} + \sum_{m=1}^{k} \varphi_m (\text{Exchange rate})_{t-m} + \sum_{p=1}^{k} \psi_p (\text{Inflation rate})_{t-p} + \sum_{q=1}^{k} \gamma_q (\text{Money supply})_{t-q} + \mu_2
\]

\[
(\text{Exchange rate})_t = \vartheta + \sum_{i=1}^{k} \beta_i (\text{Stock price index})_{t-i} + \sum_{j=1}^{k} \varphi_j (\text{Interest rate})_{t-j} + \sum_{m=1}^{k} \varphi_m (\text{Exchange rate})_{t-m} + \sum_{p=1}^{k} \psi_p (\text{Inflation rate})_{t-p} + \sum_{q=1}^{k} \gamma_q (\text{Money supply})_{t-q} + \mu_3
\]

\[
(\text{Inflation rate})_t = \tau + \sum_{i=1}^{k} \beta_i (\text{Stock price index})_{t-i} + \sum_{j=1}^{k} \varphi_j (\text{Interest rate})_{t-j} + \sum_{m=1}^{k} \varphi_m (\text{Exchange rate})_{t-m} + \sum_{p=1}^{k} \psi_p (\text{Inflation rate})_{t-p} + \sum_{q=1}^{k} \gamma_q (\text{Money supply})_{t-q} + \mu_4
\]

\[
(\text{Money supply})_t = \pi + \sum_{i=1}^{k} \beta_i (\text{Stock price index})_{t-i} + \sum_{j=1}^{k} \varphi_j (\text{Interest rate})_{t-j} + \sum_{m=1}^{k} \varphi_m (\text{Exchange rate})_{t-m} + \sum_{p=1}^{k} \psi_p (\text{Inflation rate})_{t-p} + \sum_{q=1}^{k} \gamma_q (\text{Money supply})_{t-q} + \mu_5
\]
Where

\(\alpha, \vartheta, \varphi, \tau, \text{and } \pi\) are constants, \(k\) = number of lags, \(\beta_i, \varphi_j, \varphi_m, \varphi_p, \gamma_q\) are coefficients with their levels \(i, j, m, p, \text{and } q\) respectively.

\(t = \text{time}\)

In these models, the dependent variable is a function of its lagged values and the lagged values of other variables in the model and all variables have equal lags \((k)\).

3.8 Data Analysis and Procedures

Data was entered through Excel and be exported in STATA for analysis. The study used descriptive and time series analysis.

3.8.1 Descriptive Analysis

The descriptive analysis involved means, standard deviations, maximum and minimum values of the study variables. Therefore, means, median, standard deviations, maximum and minimum value, and range of exchange rate, inflation rate, interest rate, and money supply and stock price index (DSEI) of five years (2012-2019) were presented.

3.8.2 Time Series Analysis

The data nature lets the research to apply time series analysis. The research used preliminary tests such as the unit root test (Augmented Dickey-Fuller test), Optimal Lag Length Selection, and Co-integration test to see the fitness of data for further time series tests. Additionally, the study made the test of Granger causality, Vector Auto-Regressive (VAR), or Vector Error Correction Model (VECM) depends on the co-integration of variables to achieve the desired results.
3.8.2.1 Preliminary Tests

Time series data is sensitive to some properties in which their presence affects the results from the data; thus the preliminary test was carried out to establish the fitness of the data.

- **Unit Root Test**

The Stationarity is a vital assumption of a time series data, non-stationary data may result in spurious results and conclusions hence time series data must be analysed to identify whether the time series data has a non-stationary (unit root) or not. Therefore, the test of Augmented Dickey-Fuller (ADF) was useful to identify the existence of stationarity in the time series data. The unit root test involves the following equations;

\[
\Delta Y_t = \gamma Y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-1} + \epsilon_i \tag{7}
\]

\[
\Delta Y_t = \alpha + \gamma Y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-1} + \epsilon_i \tag{8}
\]

\[
\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-1} + \epsilon_i \tag{9}
\]

Where

- \(\alpha = \text{Constant}\)
- \(p = \text{Number of lags, } t = \text{time trend}\)
- \(\epsilon_i = \text{error term}\)

The null hypothesis is \(H_0: \gamma = 0\), The alternative \(H_1: \gamma < 0\).

The test begins from equation (9) to equation (7), if the test rejects the \(H_0: \gamma = 0\), then this time series data is stationary, if the test is not rejected in those three equations, then the time series data is counted as non-stationary.

- **Optimal Lag Length Selection**

Co-integration may be sensitive to lag length, a lot of lags reduce the power of the test due to loss of degrees of freedom and estimation of additional parameters while
too few lags may fail to capture the dynamics of the actual error correction process and thus arriving at poor results.

The optimum lag length is therefore needed to avoid the pitfalls, there are several criteria for deciding the optimal lag length, they include information based criteria such as Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), and the ScharzBayesian Information Criterion (SBIC). These select a lag with the least value to be the optimal lag length. Others include the likelihood ratio test (LR) which compares a VAR with one with p–1 lag and the Final prediction error criterion (FPE) which selects the lag with the least value to minimize the prediction error (Maysami & Koh, 2000). Select the information criterion with the least value, but the information criteria give conflicting results on the optimum lag length decision criteria is purely a decision of the researcher, this is informed by the fact that none of the criteria is considered superior to the others but such a decision must be justified.

- **Co-integration Test**
Co-integration exposes that the time series data is not stationary and co-integration analysis is useful to prove whether there is a long-term relationship more than one variable. Hence, the test statistic values were compared with the critical values of the Johansen-Granger co-integration test. The co-integration null hypothesis is that “there is no co-integration”, and the alternative hypothesis is that “there is co-integration”. If the absolute statistical test value is greater than the critical value of the absolute table, then the null hypothesis is rejected (Brooks, 2019). If there is a rejection of the null hypothesis, it can be concluded that the time series is co-integration. The co-integration presence is an initial stage for applying VECM in time series data.

**3.8.2.2 The Time Series Models Selection**
Since the study encompasses a multivariate time series data, then the accessible models to study the data set are the vector autoregressive models (VARs). Therefore, the VAR model and the VECM are the two important models in this study. As indicated by Hansen (2016), the core difference between these two models is that
VECM needs the series to be co-integrated while in the VAR model there is no need for co-integration. Presence or non-presence of co-integration dictates which of the two models should be fitted for the data set in the study.

- **Vector Auto-Regression Model**
  Vector Autoregressive (VAR) is a model in econometrics that captures values and interdependencies between multiple time series and generalizes univariate (VARs) models (Brooks, 2008). In VARs all variables are considered to be endogenous and each variable in the VAR model is a function of its own lagged values (past values) and lagged values of all the other variables in the model. In Vector auto-regressive Model the series are non-stationary at levels and are not co-integrated, first differencing is thus carried out to induce stationarity before the VAR model is estimated. Thus VAR is integrated to order one I (1).

The VAR model.

\[
y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \cdots + \beta_k y_{t-k} + \mu_t + \epsilon_t \]

Adapted from Brooks, (2019).

Where;

- \( \beta_0 \) - Constant or intercept
- \( \beta_1, \beta_2, \ldots, \beta_k \) - n x n matrices coefficients that relate to variables lagged values to their present values
- \( t - 1, t - 2 \ldots, t - k \) = number of lags.
- \( y_t \) = Model variable at time t

- **Vector Error Correction Model**
  The model of VAR does not need the variables to be co-integrated if the variables are co-integrated, the dynamics in the time series is not captured through a VAR model. Therefore, the substitution model known as VECM was useful to capture the relationships between the variables in this study. VECM could, therefore, be described as a restricted and differenced VAR model, used for co-integrated non-stationary variables. VECM explains short term variables dynamics limiting long term variables relationships through co-integrating relations, the error correction term represents the deviation from the long-run equilibrium.
The VECM,

Suppose there are four variables y, w, x, and z in the model.

\[
\Delta y_t = \Gamma(y_{1,2,3,t-1} + (\beta_1 \Delta w_t + \beta_2 \Delta x_t + \beta_3 \Delta z_t + \beta_4 (y_{1,t-1} - y_{1,t-1} - y_{2,t-1} - y_{3,t-1})) + 
\mu_t \tag{8}
\]

Adapted from Brooks (2019),

Where

\( \beta_{1,2,3} = 4 \times 4 \) first difference coefficient matrices (short-run parameters) for w, x, and z on y

level matrix of the variables in \( y_{t-1} \) and contains long-run equilibrium relationships and a rank that is equal to the co-integrating vectors.

\( \Delta = \) Difference operator

\( (y_{1,t-1} - y_{1,t-1} - y_{2,t-1} - y_{3,t-1}) = \) The lagged error correlation term (ECT)

\( \beta_4 = \) Speed of adjustment back to equilibrium

\( t - 1, t - 2 \ldots, t - k = \) number of lags

\( y = \) model dependent variables

3.8.2.3 Causality Test

Causality analysis is normally carried done to review the presence of a causal connection of variables in a study. The test of Granger causality Wald test was employed to identify the existence of these relationships between the outcome variable and the response variables. The tests of causality examine the causal relationship between variables in the model but fail to report the relationship sign or how long their effects will last (Brooks, 2008). A variable in the test is considered to cause another if the value of F-statistics is significantly different from zero (Pindyck, 1998). There is a rejection of the null hypothesis that “A does not cause B” when the value of F-statistic is significantly different from zero.
CHAPTER FOUR
PRESENTATION OF FINDINGS

4.1 Introduction
This chapter presents the findings per objectives. The target of the research was to
investigate the relationship between macroeconomic factors and stock price index at
DSE. In this chapter, the descriptive and time-series analyses were performed per
specific objectives, and hypotheses. The descriptive analysis involved means,
median, standard deviations, maximum and minimum values of the study variables
where means, median, standard deviations, maximum and minimum value, and range
of exchange rate, inflation rate, interest rate, and money supply and stock prices
index of eight years (2012-2019) were presented. The data nature lets the research to
apply time series analysis. The research used preliminary tests such as the unit root
test (Augmented Dickey-Fuller test), Optimal Lag Length Selection, and Co-
integration test to see the fitness of data for further time series tests. Additionally, the
study made the test of Granger causality, and Vector Auto-Regressive (VAR).

4.2 Descriptive Analysis
The descriptive analysis involves means, standard deviations, maximum and
minimum values of the study variables. The study used summary descriptive
statistics to present the findings.

4.2.1 Summary Descriptive Analysis
The study applied means, median, standard deviations, maximum and minimum
value, and range of exchange rate, inflation rate, interest rate, and money supply and
stock price index of 2012-2019 to present findings. Table 4.1 illustrates the
descriptive statistics of the macroeconomic activities and stock price index.
Table 4.1: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Median</th>
<th>Max</th>
<th>Min</th>
<th>Std. dev</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock price index</td>
<td>2101.916</td>
<td>2127.405</td>
<td>2743.39</td>
<td>1317.52</td>
<td>2743.39</td>
<td>-0.4654</td>
<td>2.188832</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>1982.688</td>
<td>2179.415</td>
<td>2334.58</td>
<td>1505.41</td>
<td>303.5152</td>
<td>-0.3485145</td>
<td>1.274418</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>6.665</td>
<td>5.5</td>
<td>19.73</td>
<td>3</td>
<td>4.049725</td>
<td>1.919141</td>
<td>5.940994</td>
</tr>
<tr>
<td>Interest rate</td>
<td>11.08344</td>
<td>10.595</td>
<td>18.55</td>
<td>4.04</td>
<td>3.410339</td>
<td>1.586051</td>
<td>2.360949</td>
</tr>
<tr>
<td>Money supply</td>
<td>10.80281</td>
<td>11.4</td>
<td>19.2</td>
<td>1.3</td>
<td>3.803854</td>
<td>-0.2581106</td>
<td>2.495737</td>
</tr>
<tr>
<td>Observation</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
<td>96</td>
</tr>
</tbody>
</table>

Source: Researcher (2020)

Findings in Table 4.1 indicate that in a total of 96 observations, the stock price index has a mean of 2101.916, a median of 2127.405 and a standard deviation of 2743.39. Moreover, the result indicates that the maximum and minimum value of the stock price index from 2012 to 2019 is 2127.405 and 1317.52 respectively. The rate of exchange has a mean of 1982.688, a median of 2179.415 and a standard deviation of 303.5152 in the respective years. Moreover, the result indicates that the maximum and minimum value of interest rate are 2334.58 and 303.5152 respectively.

Findings in Table 4.1 also show that the mean, median, standard deviation of the inflation rate are 6.665, 5.5, and 4.049725 respectively. Also, the inflation rate has a maximum value of 19.73 and a minimum value of 3 in the respective years. Moreover, findings show that the mean, median, and standard deviation of interest rates are 11.08344, 10.595, and 3.410339 respectively. Also, findings indicate that the interest rate experienced the maximum and minimum value of 18.55 and 4.04 respectively. Likewise, the money supply experienced the mean, median, and standard deviation of 10.80281, 11.4, and 3.803854 respectively. Furthermore, findings show that the money supply in the respective years has a maximum value of 19.2 and a minimum value of 1.3.

Furthermore, to indicate the distribution of data, the research applied histogram for stock price index, exchange rate, inflation rate, interest rate, and money supply to display the distribution of skewness and kurtosis. As a general thumb rule: if the deviation is less than -1 or greater than 1, then the distribution is highly or very
skewed. The presentation of the distribution of data has been illustrated in histogram in appendix II.

As indicated by George and Mallery (2010), the acceptable range of asymmetry and kurtosis to prove univariate normal distribution should be between -2 and +2. Also, as indicated by Brown (2016) if the deviation is between -1 and -0.5 or between 0.5 and 1, then the distribution is distributed fairly or moderate. If the deviation is between -0.5 and 0.5, the distribution is approximately symmetry.

Findings show that the stock price index, exchange rate, inflation rate, interest rate, and money supply have a skewness of -0.4654, -0.3485145, 1.919141, .1586051, and -0.2581106 respectively. Findings reveal that the stock price index is approximately symmetry, the exchange rate is negative moderate skewed, the inflation rate is positive moderate skewed, the interest rate is positive moderate skewed, and the money supply is approximately symmetry.

For the case of kurtosis, the general rule is that if the number is greater than +1, then the distribution shows its peak. Likewise, when kurtosis is less than -1, then indicates the distribution is very flat (Hair Jr, Sarstedt, Ringle, & Gudergan, 2017). Findings in Table 4.1 indicate that the stock price index, exchange rate, inflation rate, interest rate, and money supply have kurtosis for 2.188832, 1.274418, 5.940994, 2.360949, and 2.495737 respectively.

4.3 Preliminary Tests

The research used preliminary tests such as the unit root test (Augmented Dickey-Fuller test), Optimal Lag Length Selection, and Co-integration test to see the fitness of data for further time series tests.

4.3.1 Unit Root Test

Stationarity is a significant property feature of time series data since non-stationary data may lead to a false (misleading) result and conclusion, therefore time series data must be analysed to identify whether the time series data contains non-stationary data (the problem of a unit root) or not. The test of Augmented Dickey-Fuller (ADF) was used to identify the presence of stationarity on the time series data. The study opted
to use ADF since ADF can take care of correlation in error term by adding lags. The ADF test can be of three results; first, series are integrated of order zero (This is stationary in level requires no differencing); second, series are integrated of order one (That is stationary after the first difference); third, series are integrated of a different order (That is having a combination of order zero and order one). ADF test was conducted and findings are indicated in Table 4.2. The study applied the following hypothesis to perform the unit root test;

Null Hypothesis: Time series data is non-stationary (a problem of a unit root)

Alternative Hypothesis: Time series data is stationary

**Table 4.2: Augmented Dickey-Fuller Test for Unit Root**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Exchange rate</th>
<th>Inflation rate</th>
<th>Money supply</th>
<th>Interest rate</th>
<th>Stock price index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test statistic</td>
<td>-0.948</td>
<td>-3.286</td>
<td>-2.570</td>
<td>-2.131</td>
<td>-1.594</td>
</tr>
<tr>
<td>1% Critical Value</td>
<td>-4.053</td>
<td>-4.053</td>
<td>-4.053</td>
<td>-4.053</td>
<td>-4.053</td>
</tr>
<tr>
<td>MacKinnon approximate p-value for Z(t)</td>
<td>0.9507</td>
<td>0.0685</td>
<td>0.2937</td>
<td>0.5288</td>
<td>0.7948</td>
</tr>
<tr>
<td>Conclusion</td>
<td>Non-stationary</td>
<td>Non-stationary</td>
<td>Non-stationary</td>
<td>Non-stationary</td>
<td>Non-stationary</td>
</tr>
</tbody>
</table>

**Source: Researcher (2020)**

Findings in Table 4.2 indicate the result of the test of ADF where the study used Mackinnon approximate p-value for Z(t) and the value of Z(t) to test the stationarity of time series data. The condition for the stationarity of time series data is that test statistic should be greater than the critical value at 1% or 5% or 10% and the p-value should be significant at least on a 5% level. Findings in Table 4.2 reveal that variables failed to meet the condition of stationarity (Mackinnon approximate p-value for Z(t) >5%). Therefore, null hypothesis i.e. time series data is non-stationary, cannot be rejected. Since all variables in the study are non-stationary, then, further
analysis cannot be implemented on them. If a time series has a unit root problem, the first difference of such a time series is ‘stationary’. Hence, the first difference of the variables should be taken to solve the problem. The first difference of a time series is the series of changes from one period to the next. Therefore, first-order differencing of time series variables was made and findings are presented in Table 4.3.

**Table 4.3: Dickey-Fuller Test for Unit Root (First order differencing of time series variables)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Exchange rate</th>
<th>Inflation rate</th>
<th>Money supply</th>
<th>Interest rate</th>
<th>Stock price index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpolated Dickey-Fuller</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% Critical Value</td>
<td>-4.055</td>
<td>-4.055</td>
<td>-4.055</td>
<td>-4.055</td>
<td>-4.055</td>
</tr>
<tr>
<td>MacKinnon approximate p-value for Z(t)</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Conclusion</td>
<td>Stationary</td>
<td>Stationary</td>
<td>Stationary</td>
<td>Stationary</td>
<td>Stationary</td>
</tr>
</tbody>
</table>

**Source: Researcher (2020)**

Since, Mackinnon p-value for Z(t) < 5% (for all variables), then, null hypothesis i.e. time series data is non-stationary, is rejected. Therefore, the exchange rate, inflation rate, interest rate, and money supply, and stock price index are stationary at the first difference, and hence, further analysis can be performed on them.

### 4.4.2 Optimal Lag Length Selection

The consideration of an optimal lag length is very crucial for time series data to be free from pitfalls (such as insignificant coefficients, multi-collinearity, loss of a degree of freedom), and there are some criteria for determining the optimal lag length, including information-based criteria such as Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and Scharz Bayesian Information Criterion (SBIC). These Criteria choose the minimum value as the optimal lag length. Some other approaches to obtain optimal lag length include the likelihood
ratio (LR) test that compares a VAR with a lag of p-1 and a final prediction error (FPE) criterion that choose the least value lag to reduce the error of prediction. The choice of optimal lag length is pointed out in Table 4.4 which displays the criteria of selection order.

Table 4.4: Selection-Order Criteria

<table>
<thead>
<tr>
<th>lag</th>
<th>LL</th>
<th>LR</th>
<th>df</th>
<th>p</th>
<th>FPE</th>
<th>AIC</th>
<th>HQIC</th>
<th>SBIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-1961.54</td>
<td></td>
<td></td>
<td></td>
<td>2.5e+12</td>
<td>42.7508</td>
<td>42.8062</td>
<td>42.8879</td>
</tr>
<tr>
<td>1</td>
<td>-1421.9</td>
<td>1079.3</td>
<td>25</td>
<td>0.000</td>
<td>3.5e+07*</td>
<td>31.563*</td>
<td>31.8949*</td>
<td>32.3853*</td>
</tr>
<tr>
<td>2</td>
<td>-1409.6</td>
<td>24.6</td>
<td>25</td>
<td>0.485</td>
<td>4.7e+07</td>
<td>31.8391</td>
<td>32.4476</td>
<td>33.3467</td>
</tr>
<tr>
<td>3</td>
<td>-1385.72</td>
<td>47.749</td>
<td>25</td>
<td>0.004</td>
<td>4.8e+07</td>
<td>31.8636</td>
<td>32.7486</td>
<td>34.0564</td>
</tr>
<tr>
<td>4</td>
<td>-1364.63</td>
<td>42.189*</td>
<td>25</td>
<td>0.017</td>
<td>5.4e+07</td>
<td>31.9485</td>
<td>33.1101</td>
<td>34.8266</td>
</tr>
</tbody>
</table>

Endogenous: Stock price index Money supply Interest Rate Inflation rate Exchange rate
Exogenous: _cons

Source: Researcher (2020)

Table 4.4 gives the results of the preferred lag length in which FPE, AIC, HQIC, and SBIC prefer one (1) lag, and LR prefers four (4) lags. The decision criteria of optimum lag length are purely a choice of the researcher; this is informed by the fact that none of the criteria is considered superior to the others. This means that there is no higher criterion than the other since the lower the lag number the better the model; therefore, the study opted AIC due to its efficiency characteristics (it has the lowest value among the three criteria), thus the study chose one lag length to be used in this model as the optimal lag length. The decision criteria for optimal lag length are also supported by FPE, HQIC, and SBIC.

4.4.3 Co-integration Results

The co-integration examined the long-run relationship among the study variables. The co-integration analysis was performed to establish the presence of a long-term relationship among the variables of the study. The study null hypothesis is indicated as there is no co-integration and an alternative hypothesis is indicated as there is co-integration. According to Brooks (2008), the rejection of the null hypothesis is
achieved when the value of absolute statistics is greater than the value of absolute critical for co-integration.

In time-series data analysis it was necessary to demonstrate the existence of co-integration in determining the model between VAR and VECM to be used in the study. Co-integration is a prerequisite for VECM fitting and not a condition for VAR model fitting. Hence, the research applied the test of the Johansen co-integration test to inspect the long-run relationship among study variables. The null hypothesis and alternative hypothesis from the maximum rank zero, include:

Null hypothesis: There is no co-integration
Alternative hypothesis: There is co-integration.

The interpretation of the results is based on trace statistics and critical values as shown in Table 4.5.

### Table 4.5: Johansen Results for Co-integration

<table>
<thead>
<tr>
<th>Maximum rank</th>
<th>Parms</th>
<th>LL</th>
<th>eigenvalue</th>
<th>Trace statistic</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
<td>-1501.6034</td>
<td>0.23269</td>
<td>58.0335*</td>
<td>68.52</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>-1489.0225</td>
<td>0.14705</td>
<td>32.8715</td>
<td>47.21</td>
</tr>
<tr>
<td>2</td>
<td>21</td>
<td>-1481.4675</td>
<td>0.10930</td>
<td>17.7616</td>
<td>29.68</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
<td>-1475.9696</td>
<td>0.04840</td>
<td>6.7658</td>
<td>15.41</td>
</tr>
<tr>
<td>4</td>
<td>29</td>
<td>-1473.6129</td>
<td>0.02137</td>
<td>2.0525</td>
<td>3.76</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>-1472.5867</td>
<td>0.02137</td>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum rank</th>
<th>Parms</th>
<th>LL</th>
<th>eigenvalue</th>
<th>max statistic</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
<td>-1501.6034</td>
<td>0.23269</td>
<td>25.1619</td>
<td>33.46</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>-1489.0225</td>
<td>0.14705</td>
<td>15.1099</td>
<td>27.07</td>
</tr>
<tr>
<td>2</td>
<td>21</td>
<td>-1481.4675</td>
<td>0.10930</td>
<td>10.9958</td>
<td>20.97</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
<td>-1475.9696</td>
<td>0.04840</td>
<td>4.7133</td>
<td>14.07</td>
</tr>
<tr>
<td>4</td>
<td>29</td>
<td>-1473.6129</td>
<td>0.02137</td>
<td>2.0525</td>
<td>3.76</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>-1472.5867</td>
<td>0.02137</td>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Researcher (2020)
Findings in Table 4.5 display that at maximum rank zero, the trace statistic is less than critical values. Thus the null hypothesis is failed to be rejected. Similarly, this advocates that the time series variables (exchange rate, inflation rate, interest rate, and money supply and stock price index) are not co-integrated. This shows that there is no long-run relationship among macroeconomic variables on the stock price index. Moreover, these results show that the series are not related and cannot be combined linearly. Following these results, the study applied unrestricted VAR to time series exchange rate, inflation rate, interest rate, and money supply, and stock price index.

### 4.5 Results From VAR

Sample: February 2002 - December 2013 No. of observation = 95

<table>
<thead>
<tr>
<th>Equation</th>
<th>Parms</th>
<th>RMSE</th>
<th>R-sq</th>
<th>chi2</th>
<th>P&gt;chi2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock price index</td>
<td>6121.5520,9101962.25230.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inflation rate</td>
<td>6.6965290.9682953.4020.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest rate</td>
<td>61.307570.8617592.0815 0.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exchange rate</td>
<td>630.59660.99039704.4530.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Money supply</td>
<td>61.948130.7509286.35830.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Log likelihood = -1472.587 AIC = 31.6334
FPE = 3.77e+07 HQIC = 31.95929
Det (Sigma_ml) = 2.00e+07 SBIC = 32.43989
Table 4.6: VAR model results

<table>
<thead>
<tr>
<th></th>
<th>Coef.</th>
<th>Std. Err.</th>
<th>z</th>
<th>P&gt;z</th>
<th>[95% Conf.Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stock price index</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock price index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1.</td>
<td>.9036387</td>
<td>.0457262</td>
<td>19.76</td>
<td>0.00</td>
<td>.814017</td>
</tr>
<tr>
<td>Inflation rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1.</td>
<td>-7.927927</td>
<td>5.295865</td>
<td>-1.50</td>
<td>0.13</td>
<td>-18.30763</td>
</tr>
<tr>
<td>Interest rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1.</td>
<td>3.468282</td>
<td>3.978375</td>
<td>0.87</td>
<td>0.38</td>
<td>-4.32919</td>
</tr>
<tr>
<td>Exchange rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1.</td>
<td>-.0110373</td>
<td>.0732801</td>
<td>-0.15</td>
<td>0.88</td>
<td>-1.1546635</td>
</tr>
<tr>
<td>Money supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1.</td>
<td>5.878479</td>
<td>4.729489</td>
<td>1.24</td>
<td>0.21</td>
<td>-3.391149</td>
</tr>
<tr>
<td>_cons</td>
<td>183.0475</td>
<td>216.6025</td>
<td>0.85</td>
<td>0.39</td>
<td>-241.4855</td>
</tr>
</tbody>
</table>

| **Exchange rate**      |          |           |       |      |                     |
| Stock price index      |          |           |       |      |                     |
| L1.                    | .0302307 | .0115101  | 2.63  | 0.09 | .0076714           | .05279     |
| Inflation rate         |          |           |       |      |                     |
| L1.                    | -1.628428| 1.333059  | -0.12 | 0.90 | -2.775591          | 2.449905   |
| Interest rate          |          |           |       |      |                     |
| L1.                    | -.7354218| 1.001425  | -0.73 | 0.46 | -2.698178          | 1.227334   |
| Exchange rate          |          |           |       |      |                     |
| L1.                    | .9640041 | .0184458  | 52.26 | 0.00 | .927851           | 1.000157   |
| Money supply           |          |           |       |      |                     |
| L1.                    | -.1158843| 1.190493  | -0.10 | 0.92 | -2.449207          | 2.217439   |
| _cons                  | 25.63928 | 54.52253  | 0.47  | 0.63 | -81.22291          | 132.5015   |

| **Inflation rate**     |          |           |       |      |                     |
| Stock price index      |          |           |       |      |                     |
| L1.                    | .0003366 | .000262   | 1.28  | 0.19 | -0.000177          | .0008502   |
| Inflation rate         |          |           |       |      |                     |
| L1.                    | .9472535 | .030347   | 31.21 | 0.00 | .8877745          | 1.006733   |
| Interest rate          |          |           |       |      |                     |
| L1.                    | -.0038068| .0227973  | -0.17 | 0.86 | -.0484888         | .0408752   |
| Exchange rate          |          |           |       |      |                     |
| L1.                    | -.000457 | .0004199  | -1.09 | 0.27 | -.0012801         | .0003659   |
| Money supply           |          |           |       |      |                     |
| L1.                    | -.0361604| .0271015  | -1.33 | 0.18 | -.0892783         | .0169575   |
| _cons                  | .8152123 | 1.241201  | 0.66  | 0.51 | -1.617497         | 3.247921   |

| **Interest rate**      |          |           |       |      |                     |
| Stock price index      |          |           |       |      |                     |
| L1.                    | .0007322 | .0004919  | 1.49  | 0.137| -.0002319         | .0016963   |
| Inflation rate         |          |           |       |      |                     |
| L1.                    | .0564508 | .0569692  | 0.99  | 0.322| -.0552068         | .1681084   |
| Interest rate          |          |           |       |      |                     |
| L1.                    | .9127417 | .0427966  | 21.33 | 0.000| .828862           | .9966215   |
| Exchange rate          |          |           |       |      |                     |
| L1.                    | -.0001449| .0007883  | -0.18 | 0.854| -.00169           | .0014001   |
| Money supply           |          |           |       |      |                     |
| L1.                    | .0143777 | .0508765  | 0.28  | 0.777| -.0853384         | 1.140939   |
| _cons                  | -.8909501| 2.330057  | -0.38 | 0.702| -.5457779         | 3.675878   |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Stock price index| -.006453 | .0007329 | -.088 | 0.379 | -.0020816 | .0007911 |      |     |     |
| Inflation rate   | -.035674 | .0848778 | -.042 | 0.674 | -.2020314 | .1306833 |      |     |     |
| Interest rate    | .0149919 | .0637621 | 0.24  | 0.814 | -.1099795 | .1399634 |      |     |     |
| Exchange rate    | -.0022484 | .0011745 | -1.91 | 0.056 | -.0045503 | .0000535 |      |     |     |
| Money supply     | .7071548 | .0758004 | 9.33  | 0.000 | .5585888 | .8557208 |      |     |     |
| cons             | 9.004662 | 3.471527 | 2.59  | 0.009 | 2.200594 | 15.80873 |      |     |     |

**Source: Researcher (2020)**

Table 4.6 indicates the VAR model results, whereby basing at model one (1) from Table 4.6 results show that the inflation rate, interest rate, exchange rate and money supply have no significant impact on the stock price index at lag one (1). The inflation rate and exchange rate have negative coefficients on the stock price index, although they have no significant relationship with the stock price index. Moreover, interest rate and money supply have positive coefficients on the stock price index but have insignificant effect on the stock price index.

Basing on model two (2) from Table 4.6 results show that the stock price index has a significant impact on the exchange rate at lag one (1) while inflation rate, interest rate, and money supply have no significant impact on the exchange rate at lag one (1). Though the inflation rate, interest rate, and money supply have no significant relationship with the exchange rate, they also have negative coefficients on the exchange rate. Moreover, the stock price index shows a positive coefficient on the stock price index.

Basing on model one (3) from Table 4.6 results show that the stock price index, interest rate, exchange rate and money supply have no significant impact on the inflation rate, at lag one (1). The interest rate, exchange rate and money supply have negative coefficients on the inflation rate, though they have no significant relationship with the inflation rate. Moreover, the stock price index shows positive coefficients on the inflation rate but have insignificant effect on stock price index.
Basing on model four (4) from Table 4.6 results show that the stock price index, inflation rate, exchange rate and money supply have no significant impact on the interest rate, at lag one (1). The stock price index, inflation rate, and money supply have a positive coefficient on the interest rate, though they have no significant relationship with interest rate. Moreover, the exchange rate shows negative coefficients on the interest rate, though the exchange rate has no significant relationship with the interest rate.

Basing on model four (5) from Table 4.6 results show that the stock price index, inflation rate, exchange rate and interest rate have no significant impact on the money supply, at lag one (1). The stock price index, inflation rate, and exchange rate have a negative coefficient on the money supply, though they have no significant relationship with the money supply. Moreover, interest rate has positive coefficient but in significant effect on money supply.

4.6 VAR Diagnostic and Tests
After a VAR model has been established, the next stage is to examine if the chosen model gives a satisfactory data description. Therefore, VAR diagnostic and tests such as Jarque-Bera test (normality), Lagrange-Multiplier (LM) (residual autocorrelation), and stability (check stability conditions of VAR estimates) were implemented to determine the fit’s goodness in the VAR model.

4.6.1 Tests for Normally Distributed Disturbances
The research used a Jarque-Bera test of normality to check the existence of the normality distribution in the data. The testing of the normality assumption involved the following hypothesis;

Null Hypothesis: The sample data is normally distributed

Alternative Hypothesis: The sample data is not normally distributed
Table 4.7: Jarque-Bera Test

<table>
<thead>
<tr>
<th>Equation</th>
<th>chi2</th>
<th>df</th>
<th>Prob&gt; chi2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock price Index</td>
<td>85.886</td>
<td>2</td>
<td>0.0000</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>449.679</td>
<td>2</td>
<td>0.0000</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>149.421</td>
<td>2</td>
<td>0.0000</td>
</tr>
<tr>
<td>Interest rate</td>
<td>68.688</td>
<td>2</td>
<td>0.0000</td>
</tr>
<tr>
<td>Money supply</td>
<td>0.410</td>
<td>2</td>
<td>0.81460</td>
</tr>
<tr>
<td>All</td>
<td>754.083</td>
<td>10</td>
<td>0.06210</td>
</tr>
</tbody>
</table>

Source: Researcher (2020)

Results in Table 4.7 indicates that the p-value of all variables of Jarque-Bera test is greater than the level of alpha (5%), therefore, the null hypothesis (The sample data is normally distributed) cannot be rejected, hence, the data obeys the normality distribution, and this shows the goodness of fit of VAR model.

4.6.2 Test of Residual Autocorrelation

The study applied the test of LM to test the presence of residual autocorrelation. The test of LM is a standard approach for inspection of residual autocorrelation existence in VAR models. The hypothesis of the test of residual autocorrelation includes;

Null hypothesis: There is no residual autocorrelation
Alternative hypothesis: There is residual autocorrelation

Table 4.8: Lagrange-Multiplier Test

<table>
<thead>
<tr>
<th>lag</th>
<th>chi2</th>
<th>df</th>
<th>Prob&gt; chi2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.3190</td>
<td>25</td>
<td>0.72990</td>
</tr>
</tbody>
</table>

H0: no autocorrelation at lag order

Source: Researcher (2020)

Table 4.8 presents the results of the estimated values of chi-square for the one lag and two lags, the degrees of freedom, and the p-values. Since the p-value is greater than the significant level at 5%, then, the null hypothesis of no residual autocorrelation cannot be rejected. This implies that the VAR model residuals are not autocorrelated.
4.6.3 Stability Conditions of VAR Estimates

In order for the model to be effective, one of the main features is that the model must be stable. If the coefficient for each companion matrix eigenvalue is less than one (1), then, the VAR model is counted as stable. If any eigenvalue with a coefficient greater than 1 is found in the companion matrix, then, the VAR model is unstable and the prediction will explode. The VAR model instability may indicate that the model variables are not stationary, or the model is incorrect. The results of the stability conditions of VAR estimates are indicated in Table 4.9.

Table 4.9: Eigenvalue Stability Condition

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>Modulus</th>
</tr>
</thead>
<tbody>
<tr>
<td>.969283 .9214529</td>
<td>.969283 .921453</td>
</tr>
<tr>
<td>.9184898 + .04752119i</td>
<td>.9184898</td>
</tr>
<tr>
<td>.9184898 - .04752119i</td>
<td>.919718</td>
</tr>
<tr>
<td>.707077</td>
<td>.919718 .707077</td>
</tr>
</tbody>
</table>

All the eigenvalues lie inside the unit circle.

VAR satisfies stability conditions.

Source: Researcher (2020)

Findings in Table 4.9 displays that modulus for each Eigenvalue in the model is less than one; this estimated modulus satisfy the condition of Eigenvalue stability. This reveals that the estimated VAR model is stable, and thus, the model is expected to give an accurate interpretation of the results.

4.7 Granger Causality

The test of causality checks the relationship between the variables in the model and the direction of their relationship. The statistic of Granger causality checks whether the values of lagged of one variable aid the prediction of another variable. As indicated by Robert and Daniel (1998), the official definition of Granger causality tests whether the previous value of $X_t$ helps to predict $Y_t$. In the test, a variable is considered to cause another if the value of F-statistics is significantly different from zero. When the value of F-statistic is significantly different from zero, the null hypothesis that “$X_t$ does not cause $Y_t$” is rejected. Therefore, Table 4.10 indicates the results of Granger causality Wald tests in the short run.
Table 4.10: Granger Causality Wald Tests

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>chi2</th>
<th>p-value</th>
<th>Decision (α = 5%)</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock price index does not cause Granger exchange rate</td>
<td>6.8983</td>
<td>0.009</td>
<td>Reject Ho</td>
<td>Unidirectional causality</td>
</tr>
<tr>
<td>Exchange rate does not cause Granger stock price index</td>
<td>.02269</td>
<td>0.880</td>
<td>Not reject Ho</td>
<td>No causality</td>
</tr>
<tr>
<td>Stock price index does not cause Granger Inflation rate</td>
<td>1.6503</td>
<td>0.199</td>
<td>Not reject Ho</td>
<td>No causality</td>
</tr>
<tr>
<td>Inflation rate does not cause Granger stock price index</td>
<td>2.241</td>
<td>0.134</td>
<td>Not reject Ho</td>
<td>No causality</td>
</tr>
<tr>
<td>Stock price index does not cause Granger interest rate</td>
<td>2.2157</td>
<td>0.137</td>
<td>Not reject Ho</td>
<td>No causality</td>
</tr>
<tr>
<td>Interest rate does not cause Granger stock price index</td>
<td>.76001</td>
<td>0.383</td>
<td>Not reject Ho</td>
<td>No causality</td>
</tr>
<tr>
<td>Stock price index does not cause Granger money supply</td>
<td>.77521</td>
<td>0.379</td>
<td>Not reject Ho</td>
<td>No causality</td>
</tr>
<tr>
<td>Money supply does not cause Granger stock price index</td>
<td>1.5449</td>
<td>0.214</td>
<td>Not reject Ho</td>
<td>No causality</td>
</tr>
</tbody>
</table>

Source: Researcher (2020)

Results in Table 4.10 display that the stock price index causes the Granger exchange rate. There is unidirectional causality between exchange rate and stock price index. Furthermore, findings display that there is no supporting evidence to reject the null hypothesis that the exchange rate, inflation rate, interest rate, and money supply do not cause Granger stock price index respectively. Likewise, results display that there is no supporting evidence to reject the null hypothesis that stock price does not cause Granger interest rate, inflation rate, and money supply respectively.
CHAPTER FIVE
DISCUSSION OF THE FINDINGS

5.1 Introduction
This study intended to investigate the relationship between macroeconomic factors and stock price index at DSE. This section debates the findings of the study analysed in chapter four. Discussion of findings is based per specific objectives which included to; examine the relationship between the inflation rate and stock price index at DSE; examine how interest rate relates to the stock price index at DSE; examine the relationship between exchange rate and stock price index at DSE; examine the relationship between money supply and stock price index at DSE.

5.2 The Relationship Between the Inflation Rate and Stock Price Index at DSE
The study performed Johansen co-integration test to inspect the long-run relationship between inflation rate and stock price index. Findings revealed that there is no co-integration or long-run relationship between inflation rate and stock price index. Therefore, although, the inflation rate has no long-run relationship with the stock price index, still it links with the stock price index in the short run. Also, the findings of the study reveal that the inflation rate has no significant relationship with the stock price index, though it has a negative coefficient. An insignificant relationship between inflation rate and stock prices might be due to fluctuations in the economy, and various events in the country.

The results of this study is different from that of Abdalla (2014) who showed that the stock price index in DSE responds positively to the inflation rate. Moreover, Sourial (2002) reasoned a positive relationship in the context of government commitment to lower inflation, the inexistence of money illusion effect, money demand shock situation, and hedging of stock against inflation. Furthermore, the study by Kimani and Mutuku (2013), and Talla (2013) came up with a negative relationship between inflation rate and stock price index where the increase in inflation rate pull down the price of the stocks in the market.
Fisher (1930) asserted the relationship of the nominal stock return and inflation rate to move in the same direction. However, the joint work of Bredin et al. (2009) in six stock markets, Canada, France, Germany, Japan, U.K., and the U.S revealed that inflation provides little or no explanatory power in explaining stock returns. The hypothesis of the fisher is consistent with the prevailing result and compatible with the result of most past researches, especially, those conducted at the emerged stock market.

5.3 The Relationship Between Interest Rate and Stock Price Index at DSE

The study performed Johansen co-integration test to inspect the long-run relationship between interest rate and stock price index. Findings reveal that there is no co-integration or long-run relationship between interest rate and stock price index. Therefore, although, the interest rate has no long-run relationship with the stock price index, still it links with the stock price index in the short run. The findings of the study reveal that the interest rate has no significant relationship with the stock price index, though it has a positive coefficient. However, Talla (2013) found that the rate of interest was negatively correlated with the fluctuations in stock price but has no significance in the model.

An insignificant relationship between the interest rate and stock prices might be due to fluctuations in the economy, and various events in the country. However, the fluctuations of interest rates may have an impact on the stock price in the market, for example, higher interest rates can lessen the existing value of cash flows, so an increase in interest rates will increase the opportunity cost of holding cash, which will subsequently lead to substitution effects between stocks and bonds and other interest-bearing securities. Thus, regulators must retain interest rates low to boost the external economic environment as well as economic activities.

The findings of this study are different from Abdalla (2014), who shows that the stock market return responds negatively with interest rate news, similar as stated in the hypothesis. Moreover, the positive relation of interest rate with the stock price index differs from research conducted in Bursa Malaysia by Kadir, Selamat, Masuga, and Taudi (2011). The positive relation between the interest rate and stock price
index is in line with Fisher’s theory arguing that the lower the interest rate the lower motivation to save, inducing the investor to move the fund to the stock market and vice versa. According to Abdalla (2014), the interest rate affects stock price due to its inherent effect on the profit and completion, a sharp increase in interest rate award investors high returns in the bond market which induce them to sell stock and buy bonds.

Although, findings of the study showed that interest rate has no significant impact on the stock price index, however as, the theory of the Fisher effect assumes that the nominal interest rate of financial assets should move one-to-one with the expected inflation rate. Furthermore, short-term and long-term fluctuations in the rate of interest are anticipated to affect the discount rate in the same way through the impact on nominal risk-free rates.

5.4 The Relationship Between Exchange Rate and Stock Price Index at DSE

The study performed Johansen co-integration test to inspect the long-run relationship between exchange rate and stock price index. Findings revealed that there is no co-integration or long-run relationship between exchange rate and stock price index. This may mean that at DSE investors can make short-term investments. These findings are also in line with John and Kisava (2018) who found that the relationship between exchange rate and stock price index was in the short-run.

Therefore, although, the exchange rate has no long-run relationship with the stock price index, still it links with the stock price index in the short run. The findings of the study reveal that the exchange rate has no significant relationship with the stock price index, though it has a negative coefficient. An insignificant relationship between exchange rate and stock price index might be due to fluctuations in the economy. Moreover, brokers’ activities in the stock market may be among the reason for the non-existence of the relationship between exchange rate and stock price index.

The relationship between the exchange rate and the stock price index may be different. Depending on geographical region, economic conditions, relationship with the international world, and local conditions, there may be differences. Inconsistent
results may be between different countries due to trade volume, equity, economic relations, and risk assessment. Since it can be unidirectional, bidirectional, or unidirectional, it is impossible to estimate the direction of the influence of the two variables.

The difference in finding was also witnessed by Rittenberg (1993) who investigated the relationship between stock price and exchange rate in Turkey by applying Granger causality tests and found that there is a unidirectional relationship that runs from the level changes of price to changes in the exchange rate though findings reveal that no reverse relationship existed.

Muhammad et al. (2002), conducted a study in four Asian countries to identify the relationship and causality between exchange rate and stock price by using Granger causality and co-integration test between 1994 and 2000. Their research showed that both methods apply the causal test of Granger to determine whether two variables are independent or affect each other. The results of the causal test Granger showed that the exchange rate and stock price index do not Granger cause each other. It can be said that there is no relationship between these two variables. They do not affect each other, and there is no interaction between them.

5.5 The Relationship Between Money Supply and Stock Price Index at DSE

The study performed Johansen co-integration test to inspect the long-run relationship between money supply and stock price index. Finds revealed that there is no co-integration or long-run relationship between money supply and stock price index. Therefore, although, the money supply has no long-run relationship with the stock price index, still it links with the stock price index in the short run. The findings of the study reveal that the money supply has no significant relationship with the stock price index, though it has a positive coefficient.

Insignificant relationship between money supply and stock price rest upon different economic events. For instance, as indicated by Fama (1970) in the efficient market hypothesis, since one and all know industry-related information, it is easy to monitor companies operating in a specific industry, and the stock price cannot be exaggerated to obtain profits. More importantly, investors usually make wise and prudent
investment decisions to be free from investment losses due to a lack of information which ultimately may affect the stock price index.

The stock price index responds positively to the money supply which is well-matched with the result of Muro and Puentes (2004), and Sellin (2001). Intuitively, Fisher’s effect theory suggested that increase in money supply in the economy may lead increase in stock price because the investor will get motivation and reduce a portion of cash to buy stock through portfolio rebalancing.

Therefore, positive or negative fluctuations in the money supply will have a positive or negative effect on the stock price index since investors will purchase or sell stocks. Also, basing on the positive relationship of money supply and stock price, the increase in money supply causes stock market returns to increase indicating that the increase results in expanded productions by companies and then increases sales resulting in increased earnings for firms which results in better dividend payments for firms leading to an increase in the price of stocks.

The more the money supply the higher the stock market returns, which signifies that the high corporation output growth, so the increase in sales leads to an increase in the company’s profits, which in turn brings better dividends to the company.

As indicated by Sirucek (2013), in the long run, the most significant factor affecting the stock prices progress is the money amount in the economy, because when the amount of money in the economy exceeds the available amount, the money supply directly affects the stock price. Moreover, Talla (2013) supported this whereby as the money stock raises, it encourages the growth of the economy, thereby increasing the firm’s credit for expanding production, and then increasing sales and the firm’s profits. This leads to a better payment of dividends, which leads to higher stock prices, though the supply of money may be inversely (negative) related to stock prices.

Therefore, an increase in the money supply may prompt the investors to direct more money to buy stocks in anticipation of an increase in stock dividends due to the rise in expected future cash flows. The rise in profit and propensity to save results in
increased liquidity. Although this study finds an insignificant relationship between money supply and stock price index, however, it suggested that the central bank must remain cautious when changing the supply of money in the stock market because a large increase in the supply of money will affect the stock market and investment.
CHAPTER SIX
SUMMARY, CONCLUSION, AND POLICY IMPLICATIONS

5.1 Introduction
This chapter indicates summary, conclusion, and policy implications.

5.2 Summary
The research aimed to investigate the relationship between macroeconomic factors and stock price index at DSE.
This study mainly intended to investigate the relationship between macroeconomic factors and stock price index at DSE. Specifically, the study intended to examine the relationship between the inflation rate and stock price index at DSE; examine how interest rate relates to the stock price index at DSE; examine the relationship between exchange rate and stock price index at DSE; examine the relationship between money supply and stock price index at DSE.
The research was carried out at DSE. The causal research design with the quantitative approach was used to study macroeconomic factors and stock price index relationship at DSE. To accomplish the study, the monthly data of stock prices for the last eight years (2012-2019) was taken from DSE.
The descriptive and time-series analyses were performed per specific objectives, and hypotheses. The descriptive analysis involved means, median, standard deviations, maximum and minimum values of the study variables where means, median, standard deviations, maximum and minimum value, and range of exchange rate, inflation rate, interest rate, and money supply and stock price index of eight years (2012-2019) were presented. The research used preliminary tests such as the unit root test (Augmented Dickey-Fuller test), Optimal Lag Length Selection, and Co-integration test to see the fitness of data for further time series tests. Additionally, the study made the test of Granger causality, and Vector Auto-Regressive (VAR).
The general objective of the study was to investigates the relationship between the stock price index and macroeconomic factors at DSE. Generally, the findings of the VAR model show that the exchange rate, inflation rate, interest rate, and money supply were insignificant to the stock price index.
Specifically, the study intended to examine the relationship between the inflation rate and stock price index at DSE. The study performed Johansen co-integration test to inspect the long-run relationship between inflation rate and stock price index. Finds revealed that there is no co-integration or long-run relationship between inflation rate and stock price index. The findings of the study reveal that the inflation rate has no significant relationship with the stock price index, though it has a negative coefficient.

Also, the study intended to examine how interest rate relates to the stock price index at DSE. The study performed Johansen co-integration test to inspect the long-run relationship between interest rate and stock price index. Finds revealed that there is no co-integration or long-run relationship between interest rate and stock price index. The findings of the study reveal that the interest rate has no significant relationship with the stock price index, though it has a positive coefficient.

Moreover, the study intended to examine the relationship between exchange rate and stock price index at DSE. The study performed Johansen co-integration test to inspect the long-run relationship between exchange rate and stock price index. Finds revealed that there is no co-integration or long-run relationship between exchange rate and stock price index. This may mean that at DSE investors can make short-term investments. The findings of the study reveal that the exchange rate has no significant relationship with the stock price index, though it has a negative coefficient.

Furthermore, the study intended to examine the relationship between money supply and stock price index at DSE. The study performed Johansen co-integration test to inspect the long-run relationship between money supply and stock price index. Findings reveal that there is no co-integration or long-run relationship between money supply and stock price index. Therefore, although, the money supply has no long-run relationship with the stock price index, still it links with the stock price index in the short run. The findings of the study reveal that the money supply has no significant relationship with the stock price index, though it has a positive coefficient.
5.3 Conclusion

The study concludes per specific objective as is indicated below.

5.3.1 The Relationship Between the Inflation Rate and Stock Price Index at DSE

The study aimed to examine the relationship between the inflation rate and the stock price index at DSE. The study concludes that there is no co-integration or long-run relationship between inflation rate and stock price index. Therefore, although, the inflation rate has no long-run relationship with the stock price index, still it links with the stock price index in the short run. The study concludes that the inflation rate has no significant relationship with the stock price index, though it has a negative coefficient.

Though these results, the research offers the BOT a certain role to ensure that Tanzania’s inflation rate remains within a range that will stimulate investment, because this variable has a significant impact on investors; investors are faced with whether to invest decision. A rise in inflation will lead to a decrease in real income, and when this happens, investors will eventually sell their assets, including stocks, to increase their purchasing power. Also, grounded on the coefficient of this variable, it can be concluded that the inflation rate in Tanzania in the relevant year is within the ideal or investor-friendly level; this is due to the joint movement of the DSE market and the returns obtained.

5.3.2 The Relationship Between Interest Rate and Stock Price Index at DSE

The study aimed to examine how interest rate relates to the stock price index at DSE. The study concludes that there is no co-integration or long-run relationship between interest rate and stock price index. Therefore, although, the interest rate has no long-run relationship with the stock price index, still it links with the stock price index in the short run. Also, the study concludes that the interest rate has no significant relationship with the stock price index, though it has a positive coefficient. Hence, if Tanzania exercises significant control over interest rates, interest can bring significant benefits to their stock price through the demand-driven approach of more investors in the stock market and the supply-based approach to more expansionary investments by companies.
5.3.3 The Relationship Between Exchange Rate and Stock Price Index at DSE
The study aimed to examine the relationship between exchange rate and stock price index at DSE. The study concludes that there is no co-integration or long-run relationship between exchange rate and stock price index. This indicates that at DSE investors can make short-term investments. Although the exchange rate has no long-run relationship with the stock price index, still it links with the stock price index in the short run. The study also concludes that the exchange rate has no significant relationship with the stock price index, though it has a negative coefficient.

5.3.4 The Relationship Between Money Supply and Stock Price Index at DSE
The study aimed to examine the relationship between money supply and stock price index at DSE. The study concludes that there is no co-integration or long-run relationship between money supply and stock price index. Although the money supply has no long-run relationship with the stock price index, still it links with the stock price index in the short run. Moreover, the study concludes that the money supply has no significant relationship with the stock price index, though it has a positive coefficient.

5.4 Policy Implications
The outcome of this research clearly describes the necessity of regular and continuous revision and redesign of economic policies by sensible considering all aspects of the stock market investment. The stability of macroeconomic variables depicts the behavior of stock market performance and the investment atmosphere of the economy as a whole where the investors should focus on other factors of macroeconomic factors such as GDP. The evidence of the existence of insignificant relationship between stock price index at DSE and exchange rate, inflation rate, interest rate, and money supply call for well-conceived policies that will facilitate the investors and financial agents to focus on other factors rather than the role of these studied macroeconomic factors while deciding on resource allocation.

Although, the findings of the study indicated no relationship between macroeconomic factors and stock price index, the financial and economic literature advanced earlier in this study such as Arbitrage Pricing Theory, Efficient Market Hypothesis, and Fisher Effect Theory both imply a relationship between the
macroeconomic factors and stock price. However, these theories have been silent about determining which precise events or economic factors are likely to influence asset prices. Therefore, policymakers in the future can use this gap to establish policies that will engulf any unexpected economic event.

5.5 Limitation of the Study and Areas for Further Research

Data availability and accessibility is a very big problem in most African countries including Tanzania. This has resulted to be one of the limitations of this study as some of the data (especially stock price index) were not found on websites, thus, the researcher had to do a physical follow up in DSE. A time constraint during the conduction of the study was another limitation of the study. The time available to finish the whole project was very limited especially with this kind of studies which involves the searching of data both at DSE and BOT. Thus to meet the deadline, it needs the researcher to work hard.

The research findings are not consistently stable with the findings of the previous studies due to differences between the macroeconomic factors used, the period covered, the research methodology employed and the countries examined. For future research, it is recommended that there is a need to repeat this study taking into account these kinds of differences to make the result of studies more comparable.

Also, consistent estimates and more robust of the effects of macroeconomic variables on the stock price index could be achieved by employing the Vector Error Correction Model (VECM) analysis which was not feasible for the data series used in this study. Lastly, a possible extension of this research should be carried out to consider the impact of other macroeconomic variables such as GDP and government spending, which were not included in the analysis. Generally, the inclusion of these economic variables would be a significant contribution to account for the effect on the stock price index at DSE.
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APPENDIX I: MACROECONOMIC FACTORS AND STOCK PRICE INDEX
(2012-2019)

<table>
<thead>
<tr>
<th>Exchange rate</th>
<th>Inflation rate</th>
<th>Interest rate</th>
<th>Money supply</th>
<th>SPI (DSEI)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1588.33</td>
<td>19.73</td>
<td>13.16</td>
<td>15.1</td>
<td>1336.25</td>
<td>Jan-12</td>
</tr>
<tr>
<td>1505.41</td>
<td>19.4</td>
<td>12.23</td>
<td>15.6</td>
<td>1318.32</td>
<td>Feb-12</td>
</tr>
<tr>
<td>1575.02</td>
<td>18.95</td>
<td>12.77</td>
<td>14.8</td>
<td>1322.44</td>
<td>Mar-12</td>
</tr>
<tr>
<td>1585.04</td>
<td>18.66</td>
<td>13.8</td>
<td>12.7</td>
<td>1332.46</td>
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</tr>
<tr>
<td>1584.84</td>
<td>18.2</td>
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<td>11.1</td>
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<td>May-12</td>
</tr>
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<td>1584.15</td>
<td>17.4</td>
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</tr>
<tr>
<td>1583.82</td>
<td>15.7</td>
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<td>12.3</td>
<td>1442.46</td>
<td>Jul-12</td>
</tr>
<tr>
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<td>1575.99</td>
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<td>12.27</td>
<td>13</td>
<td>1457.61</td>
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<td>1577.62</td>
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<td>13</td>
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</tr>
<tr>
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<td>12.1</td>
<td>11.85</td>
<td>15.1</td>
<td>1474.5</td>
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<tr>
<td>1578.41</td>
<td>12.1</td>
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<td>16</td>
<td>1485.63</td>
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</tr>
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<td>1584.49</td>
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<td>10.26</td>
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</tr>
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<td>1595.14</td>
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<td>11.8</td>
<td>14.6</td>
<td>1506.34</td>
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<tr>
<td>1623.33</td>
<td>6</td>
<td>8.68</td>
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<td>1632.93</td>
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<td>1594.39</td>
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<td>1602.9</td>
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<td>19</td>
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APPENDIX II: HISTOGRAM FOR STOCK PRICE INDEX, INFLATION RATE, INTEREST RATE, EXCHANGE RATE AND MONEY SUPPLY.

Histogram Graph for Stock Price Index
Histogram Graph for Inflation Rate to Stock Price Index

Histogram Graph for Interest Rate to Stock Price Index
Histogram Graph for Exchange Rate to Stock Price Index

Histogram Graph for Money Supply to Stock Price Index