IN THE CURRENT GLOBAL ECONOMIC CLIMATE, WHAT ARE THE FACTORS THAT WILL AFFECT THE RINGGIT EXCHANGE RATE?

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DECLARATION

We hereby declare that:

(1) This undergraduate FYP is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this FYP has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) Equal contribution has been made by each group member in completing the FYP.

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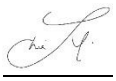
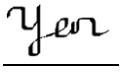
1. Chia Jing Ying	20ABB03750	
2. Kong Weng Yan	19ABB04023	
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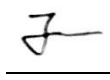
4. Liew Kai Jun	19ABB03259	

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LIST OF ABBREVIATIONS

ARDL	Autoregressive distributed lag
ADF	Augmented Dickey-Fuller
BNM	Bank Negara Malaysia
CPI	Consumer Price Index
IFE	International Fisher Effect
IRP	Interest Rate Parity
KPSS	Kwiatkowski-Phillips-Schmidt-Shin
OPR	Overnight Policy Rate
PPP	Purchasing Power Parity
RMB	Ren Min Bi
SICM	Short term capital movement
VDC	Variance decomposition
VECM	Vector Error Correction Model

PREFACE

Final Year Project (FYP) is considered as a research methodology and project. In order to qualify the Bachelor of Finance course, this project must be conducted by the students in their final years and cannot be failed. This study is conducted under the title of 'In The Current Global Economic Climate, What Are The Factors That Will Affect The Ringgit Exchange Rate?'

There are many previous studies had conducted similar topic and the results obtained are inconsistent due to different country in the study and different method of the data collection for the factors.

Furthermore, this study is focusing on the factors that affect Malaysian Ringgit against U.S. Dollar in the long run and short run, namely interest rate, inflation rate, hot money and stock market return. In order to determine the movement of Malaysian Ringgit effectively, students should investigate the factors clearly by doing research on the related theories and previous studies.

ABSTRACT

This study aims to determine the factors that affect Malaysian Ringgit against U.S. Dollar in current world in long run and short run namely interest rate, inflation rate, hot money and stock market return. The data used in this study is secondary data while 55 observations are being obtained in quarterly manner, covering from Q1 2009 to Q3 2022. The data is being derived from different sources like World Bank database, Bank Negara Malaysia, Ceic database, Yahoo Finance, and Department of Statistic Malaysia (DOSM). Furthermore, data is analyzed by using Eviews version 12. The tests carried out in this study include unit root test, long run relationship, short run dynamics and diagnostic checking. The results showed that only hot money and stock market return have long-run significant relationship with Malaysian Ringgit against U.S. Dollar while the others are insignificant. In addition, the result of this study is inconsistent with some previous studies because the data used by our study might be different with the previous study. However, there are also a few previous studies stated that the exchange rate of different country should be determined with different factors, therefore the results might be ambiguous sometimes. For instance, some previous studies took inflation rate differential to conduct the study but this study is using CPI for the inflation rate factor. In addition, some limitations had been determined in this study such as limited data available and other potential factor can be used by this study while there are also recommendations had been suggested for the potential readers on the future studies.

CHAPTER 1: RESEARCH OVERVIEW

1.1 Research Background

Recently, the depreciation of Malaysian Ringgit has been a hot issue due to impact of COVID-19 pandemic, Russia-Ukraine war, U.S. interest rate hikes and local political issues. Malaysian Ringgit depreciation has elevated import expenses of local businesses that involve in international transactions such as sourcing raw material from overseas. The financial pressure being put on businesses could ultimately be transferred to consumers by rising prices, which resulted in inflation. As the wages of consumers remain and unemployment issue arises when businesses cut cost, purchasing power drops. Ultimately, Malaysian Ringgit depreciation leads to slow economic growth (Adam Aziz, 2023). Thus, it is crucial to find out the history and determinants of Malaysian Ringgit.

Between late 1980s and early 1990s, which was the period when Asian economic miracle happened, hot money flow into ASEAN countries attained an impressive economic milestone with 8% to 12% growth in gross domestic product (GDP), thanks to the outperforming exports and foreign investments. In 1997, the hot money bubble burst and triggered Asian financial crisis to happen. This crisis started in Thailand and was extended to the other Asia countries. Thailand used to peg their currency to the U.S. Dollar so that the currency values and prices of goods were less volatile and were more favourable for importers. Pegged currency and attractive interest rate has attracted foreign investments to Asia. However, the U.S. raised interest rate for recession recovery in mid of 1990s, attracting the investors to divest from Asian countries and invest in U.S. market to yield higher return. This hiked U.S. Dollar value, making currencies pegged with U.S. Dollar to appreciate and harming the exports of Asian

countries. Thailand was forced to unpeg their currency due to plunge in export and short of foreign currency to support Thai Baht value, which eventually led to capital flight (CFI Team, 2022).

Many speculators withdrew their investment from other East Asian countries as they suspected that they were similar as Thailand, which the currency was overvalued. In Malaysia, Malaysian Ringgit depreciated from RM2.4000/$ to RM4.9000/$, causing net portfolio investment to plummet from net inflow of RM10.3 billion in 1996 to net outflow of RM12.9 billion in 1997 due to hot money withdrawal by foreign speculators. The chain effect led to banking crisis which stock market plunged and bad debts hiked. However, the situation revolved into an economic crisis when Malaysia adhered to standards and procedures in dealing with financial crisis outlined by International Monetary Fund (IMF). Therefore, National Economic Recovery Plan was introduced in July 1998, which Bank Negara Malaysia (BNM) implemented expansionary monetary policy by slowly lowering interest rate from 11% in July 1998 to 3% in December 1999. Also, fixed exchange rate regime was adopted to reduce currency value volatility by maintaining exchange rate at RM3.8000/$ (Lim & Goh, 2012).

Since July 2005 when economic was believed to have been recovered, Malaysia has been implementing managed floating exchange rate regime. This enables Malaysian Ringgit to move according to the macroeconomic and microeconomic conditions as well as the international financial expansions; at the same time BNM can intervene, when necessary, to tackle extreme market volatility to ensure that Malaysian Ringgit is maintained as close as possible to its intrinsic value (Bank Negara Malaysia, 2005). Thanks to the unpegging, total international trade has increased by 124% since the past decade as in 2013 (Norzila, 2013). In fact, BNM discovered that fixed exchange rate regime was useful to cope with overly volatile market during financial crisis or political instability. However, fixed exchange rate regime does not remove volatility in long-run, but solely transfer the volatility onto inflation, which affect local prices of goods,

services and assets. This will hurt Malaysia economy and global competitiveness (Bank Negara Malaysia, 2008).

Foreign exchange interventions are conducted less often after implementing managed floating exchange rate regime, which most of the interventions are done to cope with market and currency value instability. Study shows that speculative and huge short-term cash inflows and outflows such as portfolio investments are the major reason that trigger Malaysian Ringgit volatility. Within 2007 and 2008, BNM interfered the foreign exchange market to deal with the hefty portfolio inflows against U.S. Dollar which skyrocketed the international reserves by half to $125.8 billion in June 2008 from the previous $83.5 billion in January 2007. Nevertheless, the 2008 global financial crisis resulted in a stark reversal of portfolio investment, dragging down the value of Malaysian Ringgit. Hence, BNM interfered the foreign exchange market once again to reduce the downward pressure on Malaysian Ringgit, resulting in the international reserves drop by at least 26% to $88 billion in April 2009 from the previous level of $120 billion in September 2008 (Norzila, 2013). In fact, the most seriously impacted fields were GDP and international trade growth caused by currency value, instead of financial system as Malaysia has learned a lesson and enhanced the financial systems via Asian financial crisis (Lim & Goh, 2012).

In 2015, Malaysian Ringgit depreciated and exceeded RM4.0000/$ for the first time after Asian financial crisis, attaining lowest point RM4.4700/$ in September 2015. Firstly, due to high reliance on oil export, the declining oil price since 2014 hugely hit the Malaysian Ringgit value. Secondly, Malaysia foreign exchange reserves was reported to have dropped significantly by 28.3% in 2015, which is the largest decline since 2009. This indicates that Malaysia had weaker financial ability to rise Malaysian Ringgit value by intervening the foreign exchange market. Thirdly, 1Malaysia Development Berhad (1MDB) scandal was revealed which money laundering was involved. This has negatively affected investors' trust and confidence towards Malaysia market (International Banker, 2015). The weak Malaysian Ringgit has eroded foreign investors' confidence and negatively impacted economic growth as they

reduced and withdrew their investment from Malaysia financial market (The Borneo Post, 2015). The low investment capital available has restrained business expansion in Malaysia. All in all, not only the Malaysian Ringgit depreciation did not boost exports at the moment, but it slowed down the entire nation economic (Shaffer, 2015).

In recent years, many uncertainties have been experienced by the global market. The COVID-19 pandemic that outbroke in late 2019 led to the crash of stock markets in March 2020 and the lockdowns that caused economy to slowdown in many countries. Malaysia unemployment rate surged from 3.31% in 2019 to 4.55% in 2020 as companies tried to cut cost, and this has significantly reduced the overall productivity and economy performance, resulting in recession (O'Neill, 2022). Moreover, the Malaysian Ringgit value that dropped by 9.62% in three months from RM4.0550/$ in early January 2020 to RM4.4450/$ in late March 2020, was mainly caused by dropping crude oil price due to COVID-19 pandemic and Russia-Saudi Arabia crude oil price war. This situation hurt the local businesses and investors' confidence further as operating and manufacturing cost surged (Adam Aziz, 2020).

Amidst of global economy recovery from COVID-19 pandemic, Russian-Ukraine war happened since February 2022, and it disrupted the global supply chains and triggered inflation in many countries including Malaysia. During economic recovery of the U.S., inflation reached the highest level of 9.1% in July 2022, causing the Fed to hike federal funds rate aggressively from 0.25% during pandemic to 4.75% in March 2023 (Rockeman, 2022; Tepper, 2022). On the other hand, Malaysia's inflation rate hiked to highest point of 4.7% in August 2022, mainly stimulated by the rising food prices due to shortage of supply like chicken, rising transport prices due to expensive petrol prices and so forth (Tan, 2022; Asila, 2022). In order to fight inflation, BNM has raised Overnight Policy Rate (OPR) from 1.75% during pandemic period to 2.75% in March 2023 (Bank Negara Malaysia, 2023). As OPR did not increase as much as federal fund rate which stands around 4.75% as at March 2023, the U.S. market become a more attractive market for investors to generate higher return, hence Malaysian Ringgit

depreciates further against U.S. Dollar (Hayatun, 2022). It is worth noting that Malaysian Ringgit has been depreciating against U.S. Dollar since early 2021, which was from RM4.0225/$ in January 2021 to RM4.4840/$ on 17 March 2023.

In conclusion, low Malaysian Ringgit value could help to promote export, and is beneficial for Malaysia as an export-led country. However, it creates dilemma to many parties when the Malaysian Ringgit value is extremely low to the extent that it will impede Malaysia economic growth like what had happened in the 1997 Asian financial crisis. Malaysian Ringgit depreciation will hurt Malaysia economic as it will cause inflation when import cost hikes, which adds financial burden for businesses and in turn raise prices of their products. Consumers cut spending when purchasing power erodes, causing their life quality to be reduced due to unaffordability towards the more expensive goods (Woon, 2022). Moreover, foreign investors will reduce investment in Malaysia as the weak Malaysian Ringgit will affect their investment returns. Therefore, determining factors that will affect Malaysian Ringgit value is extremely crucial, especially in such tough environment today.

1.2 Problem Statement

Since Malaysia is active in international trade, especially in export activities, exchange rate is extremely essential to maintain and increase global competitiveness. The main goal of this study is to have an up-to-date study on whether interest rate, inflation rate, hot money and stock market return will affect Malaysian Ringgit exchange rate as many uncertain events such as COVID-19 pandemic, Malaysia political instability and Russia-Ukraine war happened in recent years.

Theoretically, interest rate has positive impact to currency value, which rise in local interest rate enables the home currency to appreciate (Ng & Caroline Geetha, 2020). However, many previous studies have shown inconsistent results. For instance, study done by Dekle et al. (2002) showed that Malaysian Ringgit appreciates against U.S. Dollar when interest rate hikes; in contrast, Ng and Caroline Geetha (2020) discovered that interest rate has a negative insignificant relationship with Malaysian Ringgit value against U.S. Dollar value. Moreover, according to Grauwe (2000), it was proven that the values of the major currencies are no longer related to fundamental economic variables, namely inflation rate, interest rate and output growth; thus, it is worth finding out if this situation applies to Malaysian Ringgit.

In addition, BNM has increased OPR since May 2022 to 2.75% in March 2023 to strengthen Malaysian Ringgit value and tackle inflation. Nevertheless, it can be observed that Malaysian Ringgit has depreciated by 6.94% and 7.76% against U.S. Dollar and Singapore Dollar respectively since 1 March 2022 until 17 March 2023, showing that Malaysian Ringgit value does not appreciate but instead continue to depreciate despite the rise in OPR (Ganeshwaran, 2022).

Moreover, theories state that inflation rate rise will cause home currency value to depreciate. However, studies had inconsistent findings in which inflation rate has insignificant relationship with currencies values, including Malaysian Ringgit (Ng & Caroline Geetha, 2020; Wan Mohd Yaseer Mohd Abdoh et al., 2016).

On the other hand, there are very few studies conducted on how hot money impact exchange rate. Hot money is money that moves frequently among various financial markets to yield short-term return, and it includes net portfolio investments, short-term capital flow and net errors and omissions (Gamze Şekeroğlu & Melek Acar, 2020). Hot money flows into developing countries are huge and unstable; hence, it poses foreign exchange risk as the demand and supply of Malaysian Ringgit can be volatile, causing

Malaysian Ringgit value to be uncertain. Due to the speculative investor behaviour, BNM will face challenges in intervening the foreign exchange market in line with managed floating exchange rate policy (Norzila, 2013). Based on a study done by Gamze Şekeroğlu and Melek Acar (2020) on hot money in Turkey, it was found that there is significant association in which increase in hot money leads to increment in currency value in the short run, but depreciation of the exchange rate will happen in the long run under the managed floating exchange rate regime. Since Malaysia has experienced Asian financial crisis caused by capital flight, and since Malaysia is an emerging country that speculators might find it attractive when there is economic growth expectation, it is essential to understand if hot money flow will affect Malaysian Ringgit value in today's economic environment.

Besides that, there are past studies pertaining the relationship between stock market performance and currency value, but there was extremely limited study on how Malaysia stock market performance affect Malaysian Ringgit value. The outbreak of COVID-19 pandemic caused Kuala Lumpur Composite Index (KLCI) to collapse in March 2020, reaching 1219.12 points after approximately 400 points dropped, which is the lowest point since the 2008 financial crisis. During the period when Malaysia stock market collapsed, Malaysian Ringgit depreciated seriously from RM4.1615/$ to RM4.4450/$, despite the U.S. stock market, as well as stock markets in other countries, were crashed too. In fact, it was discovered that there is bi-directional relationship between stock market performance and exchange rate in Malaysia, Thailand, Singapore, Hong Kong and Taiwan, but stock prices have negative significant relationship with exchange rate in Philippines (Lim & Sek, 2014). However, there are other inconsistent results from different studies which one of them discovered a significant relationship among the two variables, but they are not related at all amidst of crisis in the context of Malaysia, Philippines, Thailand and Indonesia (Abdulnasser Hatemi-J & Eduarda Roca, 2005).

1.3 Research Objectives

1.3.1 General Objective

This study aims to examine factors affecting Malaysian Ringgit exchange rate against U.S. Dollar in current world, namely interest rate, inflation rate, hot money and stock market return.

1.3.2 Specific Objectives

1. To study the long run relationship between Malaysian Ringgit exchange rate against U.S. Dollar and the various factors, namely interest rate, inflation rate, hot money and stock market return in current world.
2. To study the short run causality between Malaysian Ringgit exchange rate against U.S. Dollar and the various factors, namely interest rate, inflation rate, hot money and stock market return in current world.
3. To study the short run integration between Malaysian Ringgit exchange rate against U.S. Dollar and the various factors, namely interest rate, inflation rate, hot money and stock market return in current world.

1.4 Research Questions

1. What is the long run relationship between Malaysian Ringgit exchange rate against U.S. Dollar and the various factors, namely interest rate, inflation rate, hot money and stock market return in current world?

2. What is the short run causality between Malaysian Ringgit exchange rate against U.S. Dollar and the various factors, namely interest rate, inflation rate, hot money and stock market return in current world?
3. What is the short run integration between Malaysian Ringgit exchange rate against U.S. Dollar and the various factors, namely interest rate, inflation rate, hot money and stock market return in current world?

1.5 Hypotheses of Study

1. H_0: There is no long run relationship between Malaysian Ringgit exchange rate against U.S. Dollar and the factors, namely interest rate, inflation rate, hot money and stock market return.

   H_1: There is long run relationship between Malaysian Ringgit exchange rate against U.S. Dollar and the factors, namely interest rate, inflation rate, hot money and stock market return.
2. H_0: There is no short run causality between Malaysian Ringgit exchange rate against U.S. Dollar and the factors, namely interest rate, inflation rate, hot money and stock market return.

   H_1: There is short run causality between Malaysian Ringgit exchange rate against U.S. Dollar and the factors, namely interest rate, inflation rate, hot money and stock market return.
3. H_0: There is no short run integration between Malaysian Ringgit exchange rate against U.S. Dollar and the factors, namely interest rate, inflation rate, hot money and stock market return.

   H_1: There is short run integration between Malaysian Ringgit exchange rate against U.S. Dollar and the factors, namely interest rate, inflation rate, hot money and stock market return.

1.6 Significance of Study

This study investigates the presence of significant relationship between the dependent variable, namely exchange rate of Malaysian Ringgit against U.S. Dollar, and the independent variables, namely interest rate, inflation rate, hot money and stock market return. If there is significant relationship, it is essential to find out whether the relationship is positive or negative. Many past studies focused on how macroeconomic variables affect exchange rate; thus, this study is trying to expand the study on how Malaysian Ringgit value will be influenced by financial variables such as hot money and stock market return as well. This study will be useful for three main parties, which are the Malaysia policy makers, investors and traders and academic researchers.

The government and BNM have the responsibility to manage the stability of Malaysian Ringgit value via managed floating exchange rate regime and economic policies. According to Contractor (2019), developing countries like Malaysia tend to experience undervalued and overvalued of currencies, causing the currency value to be extremely volatile. When Malaysian Ringgit value is overvalued, it will hurt Malaysia's international trade competitiveness and export will shrink; when Malaysian Ringgit is undervalued, inflation soars and citizens' purchasing power will drop. In order to strengthen the weakening Malaysian Ringgit value amidst of COVID-19 recovery, BNM has raised OPR from 1.75% in pandemic period to 2.75% in March 2023, but the Malaysian Ringgit value continue to depreciate against U.S. Dollar and Singapore Dollar (Kumar, 2022). Therefore, this study will examine if interest rate is still a determinant of Malaysian Ringgit value. If no, BNM would need to seek for other alternatives to strengthen the Malaysian Ringgit value more efficiently and effectively. In addition, this study enables policy makers to identify insights and signals to predict upcoming exchange rate trend so that they could react quickly if any mishaps happen.

Besides that, this study enables investors and traders to understand the determinants for making more informed and rational investment and trading decisions. Not only macroeconomic variables are being covered, but also financial variables that are relevant to capital flows like stock market return and hot money are being studied as well. Investors and traders in foreign exchange market can forecast the trend of exchange rate by using stock market return and hot money flow, other than the traditional economic variables. Portfolio investors can also identify the exchange rate movement and restructure their portfolio, if necessary, since exchange rate volatility could affect the profitability of portfolio due to change in exchange rate and change in performance of securities and companies invested. The insights enable them to make better forecast and strategies.

Moreover, academic researchers could get an up-to-date insight on how exchange rate will be influenced by the traditional macroeconomic factors and financial variables during post-pandemic period as well. This study could be referred by the researchers for their future studies regarding exchange rate.

1.7 Chapter Layout

This study is made up by five chapters which are introduction in chapter one, literature review in chapter two, methodology in chapter three, data analysis in chapter four and discussion, conclusion and implication in chapter five.

1.7.1 Chapter One

Chapter one is the overall guideline of this study which provide a precise direction for the following chapter. Chapter one includes research background,

problem statement, general and specific research objective, research question, hypotheses of study and significance of the research.

1.7.2 Chapter Two

Chapter two of this study discusses the characteristics of interest rate, inflation rate, hot money and stock market return (independent variables) that affect Malaysian Ringgit exchange rate (dependent variable) in current world. Furthermore, it includes the review of relevant theoretical model, review of academic literature done by previous researchers, proposed theoretical framework, hypotheses development and followed by the conclusion of chapter two. The literature review in this chapter will be used as reference for further understanding and justification.

1.7.3 Chapter Three

The research methodology and data gathering employed to perform the study are primarily the subject of chapter three. A general explanation of the model design and rationale, the way data were collected, how they were processed, what scales were utilized, and how the results of the test data analysis were described and interpreted. The framework established in this chapter will be applied in the following chapter.

1.7.4 Chapter Four

The discussion of empirical findings and data analysis are the key elements of this chapter. Many test types have been adopted for diagnostic purpose, including unit root test, normality, heteroscedasticity, autocorrelation, model specification error test, CUSUM and CUSUM square. For better understanding of the outcomes, tables, graphs and charts will be utilized to visualise the results.

1.7.5 Chapter Five

Chapter five discusses the key findings and suggests the practical research implications and research limitations. Overall, it provides insights for potential users and renders recommendations for future studies in the similar subject area and issue.

CHAPTER 2: LITERATURE REVIEW

2.1 Review of Relevant Theoretical Models

2.1.1 Interest Rate Parity (IRP)

One of the presumptions used to anticipate and evaluate the exchange rate is the parity of interest rates. According to the theory, there is no arbitrage advantage

that might lead to the establishment of the foreign currency rate differential as a result of the interest rate disparities, thus the global economy is money mobilized and a perfect substitute. Interest rate parity does not always apply when there is a benefit to arbitraging. The two primary subcategories of the theory of interest rate parity are covered interest rate parity and uncovered interest rate parity. (Zhang and Dou, 2010).

2.1.2 International Fisher Effect (IFE)

IFE theory, according to Puci and Mansaku (2016), refers to an anticipated future change in the spot exchange rates of two countries' currencies. It will also affect the differences in nominal interest rates between the two nations. This hypothesis holds that changes in nominal interest rates are closely related to any changes in the value of any currency. The stronger currency of the other country results from the higher inflation rate in the country with the higher nominal interest rate. According to Andrea Salas Ortiz and Rodrigo Gomez Monge (2015), this hypothesis also states that a country with greater interest rates will have greater inflation. This will also result in an increase in actual worth when comparing the currencies of two nations.

The theoretical models IFE and Fisher Effect also have a connection to one another. The Fisher Effect best summarizes the relationship between the two variables interest rate and inflation. A country's nominal interest rate is calculated by summing its real interest rate and inflation rate. The IFE, however, expanded on the concept and showed how currency fluctuations might balance the disparity in nominal interest rates between two nations (Corporate Finance Institute, 2019).

2.1.3 Purchasing Power Parity (PPP)

One of the earliest and best-known hypotheses on how exchange rates are determined is the purchasing power parity (PPP) theory. In many current exchange rate theories, it serves as a reference point for the long-run exchange rate and has been justified as a sound model in and of itself. The assumption that prices become equal when they are stated in the same currency is heavily reliant on the idea of buying power. The idea of buying power parity states that there is a relative relationship between the exchange rate and the proportion of global to local markets, or price indices, which might be understood to mean that almost all items are comparable. The accuracy of any given exchange rate calculation theory has no bearing on the believability of this idea (Crystalina et al, 2020).

2.1.3.1 Absolute Purchasing Power Parity (Absolute PPP)

The notion of Absolute PPP states that the consumer price index should be the same worldwide if the same goods or services are priced in different nations using the same currency. Hence, absolute purchasing power ought to be preserved if the one price rule is in place (Ng & Caroline Geetha, 2020). According to Taylor and Taylor's (2004), although there would be a larger correlation between the producer prices of the two nations than the relative market prices, distinct commodity prices and national price levels appear to change together since they are reported in the same currency. Total purchasing power parity is difficult to maintain since many foreign trades involve distinguishing items or commodities rather than substitutes. As a result, consumption patterns will fluctuate globally (Ng & Caroline Geetha, 2020).

2.1.3.2 Relative Purchasing Power Parity (Relative PPP)

A deviation in market patterns between countries would result from the better version of purchasing power parity replacing the relative purchasing power parity. To avoid adjusting the actual exchange rate, however, one must require an equivalent inflation difference for the nominal depreciation. According to the relative PPP, in an environment where internal and external factors are balanced, the genuine exchange rate will be steady. Furthermore, high levels of activity would lead to increased domestic inflation and a favorable trade balance would cause the nominal exchange rate to decline (Ng & Caroline Geetha, 2020). Taylor and Taylor (2004) conclude that there is relationship between inflation rate and exchange rate, but it looks to be weakening over time.

2.1.4 Portfolio Balance Approach

This strategy is predicated on the idea that local and international bonds, as well as money, are all components of an investor's portfolio, and that changes to any one of these three assets force the investor to restore the balance of his portfolio in the way he prefers. Through changes in asset demand, the portfolio adjustment process affects exchange rates. Both foreign assets and local assets can be substituted for one another, including money. The portfolio balance strategy and the monetary method differ significantly in one important way which is the monetary approach makes the premise that domestic securities that represent assets other than money can do it. However, the portfolio balance technique claims that domestic and overseas assets cannot be properly replaced for one another (Tari and Gozen, 2018).

2.2 Review of Past Empirical Models

With reference to the established multiple linear regression model by Ng and Caroline Geetha (2020) in studying the relationship of Malaysian Ringgit exchange rate with Malaysia foreign reserve money, interest rate, and inflation rate which indicated by consumer price index from 2013 to 2015. Their results showed that only foreign reserve money is crucial determinant of Malaysian Ringgit exchange rate while both interest rate and inflation rate are insignificant.

Moreover, the study of Gang and Ma (2010) to determine the cointegration and causality among real effective exchange rate, Shanghai A Share Index, money supply (M1), consumer price index (CPI), industrial production index (IPI) as a proxy for nation's economic level, and hot money proxied by the foreign reserve change net of foreign trade surplus and utilised foreign direct investment (FDI) spanning 1995 to 2009. The result indicates long-run equilibrium exists between exchange rate and stock market index for the pair with USD and HKD post China financial liberalisation in 2005. CPI and M1 are found to have positive significance such that an increase will lead to strengthening of home currency, Renminbi (RMB). However, IPI and hot money are negative and insignificant towards RMB real effective exchange rate.

Likewise, similar methodology adopted by Lin (2012) using Autoregressive distributed lag (ARDL) and granger causality to study the relationship between exchange rate and stock market, interest rate and foreign reserve for the period of 1986 to 2010 suggested that long run relationship surfaced between exchange rate and stock market during financial crisis period owing to the spillover effect in emerging Asia namely India, Indonesia, and the Philippines. There is evidence of bi-directional causality in India, Indonesia and Korea but absent in Taiwan, stock market is found to impact to exchange market in the Philippines and Thailand. Given that the cointegration is found to be

weaker for export-oriented industries, the capital account balance is concluded to have influenced the behavior of exchange rate to a greater extent.

The econometric model developed in this study builds on the existing models discussed above, with exclusion of foreign reserve money, money supply (M1) and industrial production index, and inclusion of hot money proxied by foreign portfolio investment expressed in ARDL model to cater to the setting and objective of this study.

2.3 Review of Variables

2.3.1 Exchange Rate

Exchange rate is the value of a currency compared to another currency (Chen, 2022). The decision of the exchange rate regime depends on government's perspective towards economic condition. The fixed and managed floating exchange rate regime normally will engage with government intervention whereas the free-floating exchange rate regime is purely controlled by market forces. Other than government interference, numerous studies have proven that there are various factors that can influence the exchange rate.

Wan Mohd Yaseer Mohd Abdoh et al. (2016) have studied the relationship between export, inflation rate, and interest rate and exchange rate movement in selected ASEAN countries via Random Effect Models. From the findings, only export is found to be significant to influence the exchange rate as compared to other variables which shows insignificant relationship. In contrast, Pradyumna

Dash (2012) and Mayowa and Olushola (2013) had found out inverse result which is the interest rate could significantly influence exchange rate. They justified that interest rate is a vital indicator that reflects policy makers' effort in tackling inflation and currency value decrease by attracting investments.

Moreover, Ng and Caroline Geetha (2020) investigated the effect of interest rate, inflation rate, and foreign reserve money on Malaysian Ringgit exchange rate. The finding has implied the foreign reserve money is significantly related to exchange rate in opposite direction. It indicates that increasing export and remittance would rise Malaysian Ringgit value. On the other hand, an increasing import and foreign reserve money could bring down Malaysian Ringgit value. Likewise, Ahmed Saeed et al. (2012) have researched the determinants of exchange rate in Pakistan like foreign exchange reserves, stock money, political instability as well as total debt using ARDL. They found out that foreign exchange reserve is significant, which is consistent result with study above, and all variables are significant to influence the exchange rate.

Apart from that, Mohammad Chowdhury and Md. Tanjil Hossain (2015) also showed that the GDP growth has favorable impact on exchange rate, and it is considered as the major factor that influence the exchange rate behavior in Bangladesh by using simple linear regression model. Furthermore, the trade opening and financial opening also being studied. According to the Chen (2022), a study using pooled ordinary least square (OLS) and instrumental variable method has demonstrated that the exchange rate is negatively related with trade opening. Other than that, this study also indicated that financial opening has positive impact on exchange rate.

2.3.2 Interest Rate

Interest rate has different meaning in different perspective of people. It can be rate of return for investors or lenders when they make investment or lend money. Besides, it can be a cost for borrowers who have to pay to lenders together with principal borrowed. In fact, interest rate is also considered as significant factor that brings impact to exchange rate and usually come with high inflation.

When a country has high inflation, interest rate tends to be increased to control the rising inflation. As reflected by most of the monetary policies, interest rate and exchange rate have positive relationship as higher interest rate in a country allows lender to earn larger return than they could in the other nations; hence, more foreign capital will be attracted to enjoy this benefit (HSBC Group, n.d.). In this situation, the currency value of that country will be driven up due to increasing demand in domestic currency by foreign investors.

Dhamotharan and Mohd Tahir Ismail (2015a) used wavelet analysis to examines the causation between Malaysia's nominal exchange rate and interest rate difference against the U.S. between 1990 and 2013. It showed relatively strong causal relationship between the currency exchange rate and the nominal interest rate difference in short term and long term. The same group of researchers then applied the same method on China context and discovered the same long-term result (Dhamotharan & Mohd Tahir Ismail, 2015b). Similarly, Tafa (2015) discovered significant relationship between the variables, which proved that hike in interest rate of Albania will result in Albania currency appreciation against U.S. Dollar.

In addition, there are some researchers who investigated the relationship between interest rate differential and exchange rate. For instance, Hoffmann and MacDonald (2009) studied interest rate differentials on exchange rates in the U.S. and other G7 nations between 1978 and 2007 by using VAR model; Abdullahi Musa et al. (2021) investigated the same on Algeria, Egypt, Nigeria, and South Africa with ARDL and nonlinear ARDL (NARDL); and Long et al. (2022) studied Sino-US interest rate differences on the RMB exchange rate by using NARDL. Both studies demonstrated significant long-term impacts of interest rate differences on the home currency value. To be specific, when the interest rate differences being widened, the home currency value increases, and vice versa when interest rate differential being narrowed, which indicates that the previous appreciation will be balanced progressively in long-run. Abdullahi Musa et al. (2021) justified that greater inflation rates would decline real interest rates even to negative levels, discouraging foreign capital from investing domestically, which cause home currency value to drop.

In contrast, according to Anita Mirchandani (2013) and Tariq Mahmood Ali et al. (2015), who used Vector Error Correction Model (VECM), discovered that interest rate is significant but negative related to exchange rate, which indicates that the rise in interest rate would cause home currency value to drop. Ravindran Ramasamy and Soroush Karimi Abar (2015) who used simple regression model for studying exchange rate of Australia, Europe and United States obtained the same result. Their opinions towards the negative relationship are that the currencies of these nations have more strengths compared to the rests of the currencies, and this is driven by investors and society's trust instead of general economic factors such as interest rate.

Although interest rate is a crucial economic variable in many countries, there are some researchers suggested that it is not a vital determinant for affecting currency value, which is against the theoretical concepts. Wilson and Sheefeni

(2014) conducted a study using time series method and discovered that interest rate and exchange rate in Namibia do not have any relationship with each other. Another consistent result was discovered by Hashchyshyna et al. (2020) who adopted meta-analysis procedure to investigate 30 countries, and the researchers suggested both positive and negative insignificant relationship between interest rate and exchange rate in same proportion. They also suggested that relationship of interest rate and currency value tends to be more robust in developed nations with greater monetary freedom and salaries, as compared to less developed nations.

Wan Mohd Yaseer Mohd Abdoh et al. (2016) have completed studies on the relationship between interest rate and exchange rate using Random Effect Panel Data Analysis. The result proved that interest rate is negatively correlated with exchange rate with weak and insignificant impact. Likewise, Ng and Caroline Geetha (2020) who applied vector autoregression (VAR) method on Malaysia context, Taoufik Bouraoui and Archavin Phisuthtiwatcharavong (2015) who adopted multiple linear regression to study Thailand currency, as well as Tafa (2015) who studied on Albania interest rate and its exchange rate against EURO, discovered the same result, which interest rate is not an important factor for exchange rate movement.

2.3.3 Inflation Rate

According to Anita Mirchandani (2013), inflation rate can influence the exchange rate movement, and there is a significant correlation between them particularly in emerging nations. Inflation rate is often measured by Consumer Price Index (CPI) to measure certain price level whereby the inflation rate is

reflected by percentage change between the base year of CPI and current year CPI (Oner, 2019). When inflation happens, it will bring negative impact to the residents as well as the economy in a country. Firstly, it will erode people's buying power due to the rising of price level, but their discretionary income remains same which result in reduction in consumption amount. In this situation, businesses will be affected by increasing production cost and reducing profit as less people is willing to consume. Additionally, it also influences the economic growth with dropping GDP in a country. This is because the domestic goods are expensive than foreign goods; whereby the foreigners buy fewer domestic goods and in turn decreases export. In contrast, the import goods are cheaper for local; thus, import of country will increase. As a result, the economy may be adversely impacted with trade deficit.

In general, increased inflation will lower a country's currency value against other currencies as the purchasing power of currency is being reduced (Lowry, 2022). Such then, the country's import increases and export decreases, indicating that demand of foreign currency increases at the same time the supply of money in domestic country increase as well during inflation. Thus, the increasing of domestic country's money supply causes its exchange rate to depreciate against foreign currencies. According to Grydaki and Fountas (2010), inflation rate can either positively or negatively affect exchange rate as it depends on Central Bank. However, they more tend to have significant negative relationship as the rising inflation rate will increase price level of goods which causes more import and result in depreciation of home currency.

From past studies, Wan Mohd Yaseer Mohd Abdoh et al. (2016) demonstrated the inflation rate and exchange rate on certain ASEAN countries has an insignificant and negative relationship by using Random Effect Panel Data Analysis. It indicates that the exchange rate will depreciate as inflation rises. Likewise, the same result was also being found out by Gidigbi et al. (2018)

using VECM. The consistent finding was in long run, and there is no relationship among these two variables in short run.

Furthermore, Ng and Caroline Geetha (2020) have found out that inflation is not significantly related to exchange rate, which is similar with studies above, but they are in a positive relationship. This finding is an inverse expectation of researchers and other studies. This may be owing to the limitation of study and the researchers opine that inflation should be further investigated in future research as it might be a vital variable for influencing the economic and exchange rate.

On the other hand, some studies suggested the inflation rate and exchange rate are significantly and negatively correlated, which meets the general rule between these two variables. For instance, Anita Mirchandani (2013) has concluded a moderate indirect correlation among them which has rejected its hypothesis of high inflation will lead to exchange rate to be appreciated. This is due to a higher inflation result in currency depreciation in comparison to trading partner' currencies. Similarity, Noer Azam Achsani et al. (2010) has investigated by using Granger-causality test and explorative statistical analysis which indicates a strong negative relationship as well in Asia countries as compared to EU and North America.

Furthermore, the determinant of inflation rate differential on exchange rate also being investigated in past studies. Generally, if there is much more inflation in a nation than in the others, the nation's currency value will decline and vice versa if inflation rate is lower (Fadli Fizari Abu Hassan Asari et al., 2011). It is because purchasing power changes in relation to other countries. Nitrabampa and Iraya (2019) have discussed the relationship among these two variables in five East African Community partner states. Their findings showed a positive

and significant relationship among inflation rate differential and exchange rate. This result is against the PPP theory, and it might be due to the limited data in certain period as well as limited variables in their study. In contrast, an insignificant and negative relationship was found out by Pradyumna Dash (2012) using error correction model. This demonstrates the anticipated exchange rate pass-through of the difference inflation rate did not occur.

2.3.4 Hot Money

Foreign exchange markets deal with the purchase or sale of interest-bearing assets in a particular currency (Duarte, Alan C. Stockman, 2004). In the late 1980s, emerging market economies underwent significant structural reforms in terms of opening up of financial account, narrowing of fiscal imbalances, and disinflation measures to gain access to international capital markets. This has led to global banks and investors seeking opportunities in emerging market economies (EMEs) pumping massive short-term international capital to pursue profits amidst quantitative easing in the U.S. post subprime mortgage crisis, resulting in macroeconomic and financial instability (Committee on the Global Financial System, 2009; Boudias, 2015).

In accordance with the theory, several researchers reached consistent conclusion such that hot money is positively associated with exchange rate as liberalised and loosening capital flow leads to surging demand for home currency and thus an adjustment to the current account, ultimately appreciative effect on home currency. According to Gamze Şekeroğlu and Melek Acar (2020), Boudias (2015), Combes et al. (2012), and Ibarra (2011), the positive effects of capital inflows on economic growth are insufficient to offset the

strengthening of the domestic currency, which results in weakening international trade competitiveness as well as maturity and currency discrepancies in banks' liabilities and assets. Gamze Şekeroğlu and Melek Acar (2020), analyzed to what extent has hot money influenced the Turkish lira exchange rate using a structural equation model and concluded that inflows excite demand for home currency, leading to a decrease in exchange rates. Meanwhile, Boudias (2015) studied how had the degree of capital flows, private credit expansion, and dollarisation are determined by exchange rate regime in emerging market economies. The study found that floating exchange rate regime contributed to home currency appreciation without any other nominal impact whenever there is capital inflow. In addition, a study that reveals to what extent did public and private capital inflows affect real effective exchange rate in 42 emerging and developing countries by Combes et al. (2012) found that portfolio investments demonstrate the greatest appreciating impact, followed by FDI and bank loans, while private transfers have negligible impact, which is aligned with the findings by Ibarra (2011) in the study on Mexico. The study claimed that inflows accumulated as reserves may not lead to a real exchange rate adjustment, while inflows not accumulated as reserves may require currency appreciation to balance the current account deficit.

However, some studies reached opposing views stating that hot money is negatively associated with exchange rate. Karahan and Colak (2019), Edwards and Rigobon (2009), Roya and Kemme (2020) and Ye and Zhang (2018) found that the negative correlation is explained by the highly volatile and speculative nature of short-term capital inflow imposing a shock to the domestic money supply causing a credit boom and mispricing of risk which fuels dramatic climb in asset prices and hence depreciation of home currency. By employing ARDL on quarterly data from 2003 to 2018 in Turkey and error correction model on annual data from 1953 to 2006 in the U.S. respectively by Karahan and Colak (2019) and Roya and Kemme (2020), it is found that hot money inflows lead to

short-term appreciation but long-term depreciation of the home currency due to the compression of long term interest rate rendering the mortgage and long term loan appealing motivated by the huge capital inflow. The explosion in credit availability led to collapse in asset market and subsequently a deterioration of home currency. According to Edwards and Rigobon (2009), tighter capital flow controls result in a trade-off that equalizes spot market rates (in terms of external shocks) but distorts future nominal rates. Stringent capital controls worsen balance of payments, augment unconditional volatility of the exchange rate, and render the exchange rate less susceptible to exogenous shocks with exception of prices of international trade and interest rates. It is claimed that foreign exchange market experiences greater degree of segmentation due to capital control in Chili. The study in China using time-varying transition probability Markov-switching model on annual data from 2000 to 2015 by Ye and Zhang (2018) found that the strength of volatility and speculative tendency spikes during periods of quantitative easing policies. The managed floating regime enables the Chinese government to stabilize the RMB exchange rate using foreign exchange reserve during times of large capital inflow. This intervention channels excess liquidity in the domestic credit market which triggers climbing inflation and asset bubbles, eventually currency depreciation.

Other than that, two studies revealed mixed results with stock market intervention and their volatility spillover effects play important roles. Lee et al. (2017) applied the cointegration model, unrestricted vector autoregressive and VECM-BEKK model, and quantile regression to show that hot money has no influence on exchange while hot money had a modest quantile influence on the exchange rate market, it had a large quantile impact on the Shanghai and Shenzhen stock markets. Duarte et al. (2004) investigated this issue using a normal two-country monopolistic-competition model. They opined that real and nominal exchange rates tend to deviate upon shift in risk premia while other

key macro factors remain constant, and that exchange rates obey a forward-looking, first-order stochastic difference equation with risk premia terms.

Meanwhile, some studies suggested insignificance as evidenced by Li et al. (2018) and Kodongo and Ojah (2012). Li et al. (2018) conducted a wavelet analysis on China's economy to determine the mediating role of short-term international capital movements on the exchange rate and stock market nexus. According to the findings, short term capital movement (SICM) played a limited mediating role in describing the difference between testing the stock market and exchange rate relationship solely vis a vis testing it while controlling for SICM. However, as China advances towards Renminbi openness and capital account deregulation, the flexibility of SICM inflows will strengthen, highlighting the significance of contemplating SICM in the future. Besides, between 1997 and 2009, Kodongo and Ojah (2012) examined the link between net portfolio imports and real exchange rates in African countries (Egypt, Morocco, Nigeria, and South Africa). They discovered that the correlation between the two macroeconomic factors varied by nation and period. Furthermore, they observed that foreign portfolio movements to African nations were marked by high fluctuation and minimal persistence. Overall, their findings did not support a generalizable causative relationship between real exchange rates and net portfolio imports across all the nations under study.

On the other hand, Li et al. (2018) discovered a two-way association in this pair using the spectral coherence technique to examine the relationship between SICM and the Chinese exchange rate from 2007 to 2018. The research revealed that SICM led the exchange rate favourably in some time intervals but its effect was not uniform across all periods. Exchange rate shifts in China were also influenced by additional variables like productivity, economic openness, and crude price shocks. The study used data from 2007 M2 to 2008 M4 and from

2009 to 2018. According to the results, SICM can cause RMB strengthening under certain intervals, but its effect is not always substantial.

Exchange rate regime is a key element in deciding the connection, despite the complicated association with the interaction of various other elements. The Mundellian trilemma states that nations must choose a pair among free capital flow, fixed currency rates and monetary policy authority; and that fluid exchange rates are essential in weathering global financial upheavals. A flexible exchange rate system is promoted as the greatest financial shock absorber (Mundell, 1963; Obstfeld et al., 2005; Klein and Shambaugh, 2015). According to two studies, the choice of exchange rate system determines the connection between exchange rates and capital movements in developing market regions (Boudias, 2015). EMEs with fixed exchange rate regimes report higher dollarization during modest outflows, whereas nations with more flexible regimes face higher lending growth rates during substantial outflows. Although it may not always be the optimal course of action for EMEs during times of high global risk aversion, a more flexible exchange rate system can reduce the real appreciation brought on by capital outflows. According to these studies, the preference of exchange rate system is important in creating policy mixes to handle credit booms and debt dollarization (Combes et al., 2012).

2.3.5 Stock Market Return

In the financial economics literature, the connection between stock values and currency rates has been investigated using two theoretical approaches: the portfolio balance method and the flow-oriented model. According to the portfolio balance method, stock prices have a negative association with

exchange rates, with a drop in stock prices leading to reduced interest rates and capital withdrawals, causing currency devaluation (Walid Chkili & Duc Khuong Nguyen, 2014). The flow-oriented model, on the other hand, contends that changes in exchange rates affect trade balances and real income, thereby affecting stock prices as the current values of firms' future cash flows (Dornbusch & Fisher, 1980; Zhao, 2010). Currency appreciation, according to the goods market theory, harms importers by making their shares less attractive and lowering the share market in an export-oriented economy (Gang and Ma, 2004). According to the stock-oriented models put forth by Branson (1983) and Frankel (1983), there is a direct causal link between stock prices and exchange rates because changes in stock values lead to alterations in the supply and demand for both domestic and foreign assets (Walid Chkili & Duc Khuong Nguyen, 2014). Some contend that exchange rates can influence firm profits and stock prices (Aggarwal, 1981), or that changes in stock prices can influence capital movements and exchange rates through changes in broad money and interest rates (Krueger, 1983; Abdulnasser Hatemi-J & Eduarda Roca, 2005).

The relationship between stock prices and exchange rates is still being discussed, with some studies arguing that exchange rates cause stock prices and others claiming the reverse. A feedback cycle will predominate in marketplaces exposed to both theoretical approaches, with an arbitrary correlation between the two factors (Grangera et al., 2000). Making investments and spotting economic patterns requires a thorough understanding of the connection between stock prices and exchange rates.

The positive association is supported by Tsai (2012), Grangera et al. (2000) and Lin (2012) covering period of widespread financial crisis in 1997 and 2008 respectively. Tsai (2012) modelled in cointegration and quantile regression approach on Asian markets, Singapore, Thailand, Malaysia, Taiwan, Philippines and South Korean using monthly data from 1992 to 2009 showed

that the intensity rises during periods of exceptionally high or low exchange rates. Moreover, employing daily data from 1986 to 1998 in the study of six Asian emerging countries amidst the outbreak of Asian flu episodes, Grangera et al. (2000) concluded that pessimism in stock market due to large capital flight in Q4 1994 upon geopolitical tension at the onset of missiles attack by China has rendered the home currency to lose strength under a flexible exchange rate regime. The use of ARDL bound test enabled Lin (2012) to prove that the co-movement becomes more evident during times of crisis in India, Indonesia and the Philippines such that softening trading volume in stock market induced by economy slowdown will expedite the capital withdrawal of foreign investors which causes depreciation of home currency as demand fades. This is consistent with the asset price contagion effect, which dominates the transfer route from stock market to exchange rate.

However, Walid Chkili and Duc Khuong Nguyen (2014), Tule et al. (2018), Grossmann and Orlov (2022) and Zeng et al. (2022) achieve mutual consensus claiming that exchange rate is negatively influenced by stock market return. The study by Walid Chkili and Duc Khuong Nguyen (2014) using weekly data from 1997 to 2013 in Markov switching and VAR model spanning the period of Asian financial crisis suggested a negative relationship is expected between stock market behaviour and exchanger rate movement. It is evidenced that portfolio balance model dominates in BRICS countries, such that significant impact of stock market returns on exchange rates is observed, except South Africa. The relationship tends to increase in magnitude especially in high volatility period. With regards to Brazil and India, an upside in stock market will trigger depreciation of the home currency thus an uptick in exchange rate against foreign currency. Meanwhile, Tule et al. (2018) concluded that home currency hovering below equilibrium when there is negative long-term uni-directional shock spillover from stock return using VARMA-AGARCH approach in Nigeria context. Risk-averse foreign investors tend to liquidate

stock position to reallocate capital at a favorable exchange rate during episodes of heated stock market at its peak. The growing demand for the USD due to flock of capital from Nigeria exerts a downward pressure on Naira (home currency) due to shrinking demand. Besides, Grossmann and Orlov (2022) investigated the impact of net stock movements and exchange rate volatility using a fixed effect panel model. They identified that when the U.S. Dollar is undervalued, net stock movements have a moderating impact on exchange rate volatility in advanced economies, but a disruptive effect in emerging countries. Net stock transfers from developed nations to the United States may indicate a robust U.S. economy, sustaining long-term investments and lowering exchange rate risk linked with the U.S. Dollar. In comparison, net stock transfers from developing nations to the U.S. may be interpreted as capital flight and cause instability in the value of developing nation currencies relative to the U.S. Dollar. By focusing on the volatility behaviour Zeng et al (2022) used MGARCH coupled with Vine-Copula-CoVaR method to reveal the role of a transmission mechanism, such that exchange rate is influenced by the positive systematic risk and volatility spillover from stock market. The study opined that the association is more pronounced among paired markets of USD/CNY exchange rate, WTI crude oil futures, and the Chinese stock market post foreign exchange reform in 2005.

However, the studies of Grangera et al. (2000), Abdulnasser Hatemi-J and Eduarda Roca (2005), Seyfettin Erdoğan et al. (2020) and Gaurav Agrawal et al., 2010) found causative link between ASEAN exchange rates and stock markets proposing the role of interdependence or integration between the two markets leading to spillover running from stock market to exchange rate. Grangera et al. (2000) confirmed the causality running from stock market to exchange rate using granger causality and impulse response function on daily data from 1986 to 1998 in the Philippines which is in contrast with the results obtained by Abdulnasser Hatemi-J and Eduarda Roca (2005) using daily data

for the year 1997 modelled in Bootstrap causality tests with leveraged adjustments that the causality is absent in the country above. The study concluded that uni-directional causality from stock market to exchanger rate is observed pre-crisis period in Indonesia and Thailand but vice versa in Malaysia. This indicated that the two asset markets were either conveying information inefficiently or commonly perceived as high degree of integration that enables hedging in stock portfolio using foreign exchange. In fact, the study using daily data from 2007 to 2009 suggested that Nifty returns and exchange rates become weakly positively correlated when induced by pessimism in the stock market as interest rate is pressured lower due to dampening the demand for local currency. Investors reallocate capital in anticipation of more attractive risk-adjusted return leads to cash outflow depreciating the home currency (Gaurav Agrawal et al., 2010). By processing daily data from 2013 to 2019 in MGARCH model, Seyfettin Erdoğan et al. (2020) discovered proof of a direct connection between the Turkish foreign exchange market and the Islamic stock market. Additionally, they discovered that, starting in 2017, there was a spillover of volatility from the Islamic stock market to the foreign exchange market owing to the bullish rebound of the Islamic market index in 2017 followed by a steep decline in 2018.

Furthermore, bidirectional causality is confirmed in the studies of Seyfettin Erdoğan et al. (2020), Grangera et al. (2000), Liu and Wan (2012) and Lim and Sek (2014). Two-way volatility spillover dominates from 2018 onwards according to Seyfettin Erdoğan et al. (2020) due to intensified stock market volatility that increased the degree of integration of both markets. Data from Hong Kong, Malaysia, Singapore, Thailand, and Taiwan showed significant feedback relationships between exchange rates and stock prices, with both variables possibly assuming the lead according to Grangera et al. (2000). Liu and Wan (2012) also found significant cross-correlation between stock prices and exchange rates. The influence of international diversification, cross-market

return correlations, relaxation of capital inflow barriers, and foreign exchange restrictions affects exchange rate behaviour according to Lim and Sek (2014).

However, Zhao (2010) and Liu and Wan (2012) reported insignificant relationship between exchange rate and stock market. Based on Zhao's (2010) study using monthly data from 1991 to 2009 interpreted in Johansen cointegration and multivariate VAR–MGARCH model, RMB real effective exchange rate and equity values do not have a long-term stabilizing link due to the adoption of controlled floating exchange rate regime in China. Liu and Wan (2012) discovered that the Shanghai Composite Index is not cointegrated with the CNY/USD exchange rate prior to the financial crisis using Johansen cointegration, implying that there is no causal link between stock prices and exchange rates. In contrast, a linear causation connecting exchange rates to stock indices was discovered following the financial crisis.

Nevertheless, some study discovered contradictory results, implying that the relationship reflects the flow-oriented strategy. Grangera et al. (2000), Abdulnasser Hatemi-J and Eduarda Roca (2005), and Zhao (2010) all came to opposite conclusions. Grangera et al. (2000) used impulse response functions to investigate the connection between stock prices and exchange rates in South Korea and discovered that exchange rates precede stock prices. With the exception of the Philippines, Abdulnasser Hatemi-J and Eduarda Roca (2005) discovered a substantial causative link between exchange rates and stock values in ASEAN nations prior to the Asian crisis. They did this by modelling daily data for the year 1997 using Bootstrap causality tests. The connection between the two factors, however, stopped during the crisis in all four ASEAN nations. This suggests that the foreign exchange and equity markets became segmented, or that information transmission between the two markets became effective during the crisis. Zhao (2010) examined monthly data of real effective RMB and Shanghai composite index from 1991 to 2009 using multivariate VAR-

MGARCH and Johansen cointegration and discovered a mean spillover effect from the foreign exchange market to the stock market, with information flowing only from the exchange rate to stock price. According to the research, changes in exchange rates indicate significant changes in an economy's foreign trade factors, which are then communicated to stock prices. Since the Chinese economy is export-oriented, the volatility of exchange rates can also have an impact on the volatility of stock prices. Exchange rate changes also have a secondary impact on how competitive business goods are on global marketplaces. As a result, it is critical for investors and lawmakers to comprehend the global economy's interrelationship between exchange rates and stock values.

Depending on whether an economy is export- or import-driven, currency growth can have both positive and negative impacts on the local stock market, based on Gaurav Agrawal et al. (2010). Gang and Ma (2010) found that an increase in the value of the local currency had a beneficial impact on the Shanghai A Share index and that there was a positive correlation between the exchange rate and the money supply and stock values in their research of the Chinese economy from 1995 to 2009. A cointegration between the Shanghai A Share Index and the renminbi's exchange rate against the U.S. Dollar and Hong Kong Dollar has existed since the Chinese financial market was liberalised in 2005. The stock index shifts by 38% for every 1% difference in the conversion rate of the RMB to the Hong Kong Dollar. All whilst, Iyke and Ho (2021) discovered that only consumer goods and technology had favourable stock market exposures when using a multifactor arbitrage pricing model to study exchange rate exposure before and during the COVID-19 pandemic. According to the findings of the research, the substantial decline in the market index during the epidemic was primarily caused by industrial exposure rather than industry exposure to rand devaluation. Consumer services, financials, industrials, and telecoms were among the six sectors that reported substantial exposures, and

four of them had negative exposures. The research also discovered that when the local currency depreciates, equity returns in import-dependent sectors and industries fall.

In order to show the importance and causes of the connection between exchange rates and stock values, several studies have looked into this relationship in both directions. For both pre- and post-inflation targeting, Lim and Sek (2014) used GARCH models and vector autoregressive models to demonstrate that the interest rate, money supply, foreign reserves, lagged exchange rate volatility, and lagged stock return volatility were important causes of volatility in a number of Asian nations. In Indonesia and the Philippines, IT adoption effects exchange rate and stock return volatility differentially, whereas inflation targeting affects Thai baht and stock return volatility. Through lines of movement or stock, internal financial systems have an effect on developing markets.

2.4 Hypotheses Development

2.4.1 Lending Interest Rate

According to IFE and IRP theories, high nominal interest rate due to high inflation rate could cause home currency to depreciate. However, there is another concept where interest rate could significantly impact exchange rate as high interest rate can encourage more overseas investors to invest in the particular country which result in home currency value being increased due to higher demand (Zhang & Dou, 2010; Puci & Mansaku, 2016). However,

Wilson and Sheefeni (2014), Wan Mohd Yaseer Mohd Abdoh et al. (2016), Taoufik Bouraoui and Archavin Phisuthtiwatcharavong (2015) and Ng and Caroline Geetha (2020) discovered insignificant relationship between the two variables. In Malaysia, the rise in interest rate since recovery from Covid-19 pandemic does not show an obvious impact towards Malaysian Ringgit value against U.S. Dollar, drawing doubts on the significance of interest rate on Malaysian Ringgit value.

H_0: There is an insignificant relationship between lending interest rate and Malaysian Ringgit exchange rate.

H_1: There is a significant relationship between lending interest rate and Malaysian Ringgit exchange rate.

2.4.2 Consumer Price Index (CPI)

Generally, inflation rate is expected to negatively and significantly related to exchange rate. Majority studies have achieved the similar expected association between the variables as higher inflation rate tend to cause exchange rate to be depreciated. According to Fadli Fizari Abu Hassan Asari et al. (2011), a general rule implies that if a country continually experiences decreased inflation, its currency value will be appreciated due to increased consumer purchasing power. Similarity, Anita Mirchandani (2013) has proved the same result as the initial expectation. However, there are many studies in different countries like Nigeria and selected ASEAN countries have come out not significant finding between inflation and exchange rate although expected sign of relationship is obtained (Gidigbi et al., 2018, & Wan Mohd Yaseer Mohd Abdoh et al,2016). Other that than, some studies have found out completely opposite result where inflation

has positive but insignificant effect on exchange rate. This result was being supported in research by Ng and Caroline Geetha (2020).

H_0: There is an insignificant relationship between inflation rate and Malaysian Ringgit exchange rate.

H_1: There is a significant relationship between inflation rate and Malaysian Ringgit exchange rate.

2.4.3 Hot Money

As proposed in the theory, hot money is expected to positively and significantly related to exchange rate. Majority studies are consistent with this belief as evidenced by Karahan and Colak (2019), Edwards and Rigobon (2009), Roya and Kemme (2020) and Ye and Zhang (2018). It is believed that highly volatile and speculative nature of short-term capital inflow imposing a shock to the domestic money supply causing a credit boom and the subsequent collapse in asset market will cause depreciation of home currency. However, Gamze Şekeroğlu and Melek Acar (2020), Boudias (2015), Combes et al. (2012) and Ibarra (2011) suggested negative impact on exchange rate as portfolio investment increases demand for the domestic currency, leading to a decrease in exchange rates. Other that than, some studies fail to yield any relationship as claimed by Li, et al. (2018) and Kodongo and Ojah (2012) in China and African markets owing to country-specific and time-varying constraints as well as home currency internationalisation and capital account liberalization. Li, et al. (2018) also explained that the mixed result is contributed by the omission of other factors such as productivity, economic openness, and oil price shocks which are powerful to explain behaviour of exchange rate in a managed floating regime.

H_0: There is an insignificant relationship between hot money and Malaysian Ringgit exchange rate.

H_1: There is a significant relationship between hot money and Malaysian Ringgit exchange rate.

2.4.4 Stock Market Return

As supported by the theory proposed, stock market return is expected to influence the exchange rate in a significant negative relationship. Majority studies have achieved the similar expected association between the variables as higher stock market return tend encourages demand for local currency, hence spurring the interest rate due to strong capital inflow, thereby suppressing the exchange rate. According to Tsai (2012), Grangera et al. (2000) and Lin (2012) the negative association is validated based on the causality and cointegration such that the influence becomes more obvious when the exchange rate is at extreme level. Likewise, Grangera et al. (2000), Abdulnasser Hatemi-J and Eduarda Roca (2005), Seyfettin Erdoğan et al. (2020) and Gaurav Agrawal et al. (2010) proposed the role of market interdependence leading to spillover from stock market in the long run which is proven of the expected relationship. In fact, the inefficiency of information transmission is confirmed such that stock price induces variation in exchange rate using granger causality test. However, Walid Chkili and Duc Khuong Nguyen (2014), Tule et al. (2018), Grossmann and Orlov (2022) and Zeng et al (2022) returned opposite result suggesting that cash outflow as local stock market rises to its peak encourages risk-averse foreign fund to reallocate capital, thus the reduced demand causes home currency to depreciate. There are many studies in different countries in Asian yielded a bidirectional relationship such that there is significant cross-correlation between the variables. Clive, et al. (2000) concluded the existence of strong feedback relations in the coverage of Singapore, Hong Kong, Thailand,

Malaysia and Taiwan while Seyfettin Erdoğan et al. (2020) claimed such happen in Islamic stock market in Malaysia.

H_0: There is an insignificant relationship between stock market return and Malaysian Ringgit exchange rate.

H_1: There is a significant relationship between stock market return and Malaysian Ringgit exchange rate.

2.5 Conclusion

Past studies regarding the impacts of interest rate, inflation rate, hot money and stock market return on exchange rate are being reviewed in this chapter. All in all, there are some inconsistent results, and some are lack of empirical study. Research gaps are identified from here and they will be dealt with in this study.

CHAPTER 3: METHODOLOGY

3.1 Introduction

In this chapter, the research methodologies and theoretical framework applied is discussed in well-organized form for better understanding of the readers. Both long run relationship and short run dynamics are investigated through time series analysis on unit roots tests namely Augmented Dickey-Fuller (1979) test and Kwiatkowski, Phillips, Schmidt, and Shin (1992) test to identify the stationarity of data nature. The completion of this prerequisite procedure allows Autoregressive Distributed Lag and bound test to be performed to reveal the co-movement among variables; followed by vector autoregressions, impulse response function, variance decomposition and granger causality test to identify the behaviour of the variables in the short run. The relationship between exchange rate and the macroeconomic and financial variables adopted will be confirmed with the help of diagnostic testing.

3.2 Scope of Study

In this study, secondary data and quantitative data are being adopted. The independent variables, namely interest rate, inflation rate, hot money, and stock market return, while dependent variable, namely exchange rate of Malaysian Ringgit against U.S. Dollar, are in numerical form, which can be justified by statistical means when using quantitative research.

To evaluate the dynamic relationship between economic and finance variables and exchange rate, there are series of analysis techniques and sample outcomes will be applied. Such then, 55 observations are being obtained in quarterly manner, covering from Q1 2009 to Q3 2022. The data is being derived from different sources like World Bank database, Bank Negara Malaysia (BNM), Ceic database, Yahoo Finance, and Department of Statistic Malaysia (DOSM).

Table 3.2:

Explanation of Variables

Variables	Unit Measurements	Descriptions	Sources
Exchange rate (ER)	MYR/USD (Direct method)	Exchange rate of Malaysian Ringgit per U.S. Dollar	Bank Negara Malaysia (BNM)
Interest rate (INT)	Percentage (%)	Malaysia lending interest rate	Ceic data
Inflation rate (CPI)	Index (2010=100)	Malaysia Consumer Price Index	World Bank Database
Hot money change (HM)	Percentage (%)	Short term cash inflow from foreigners	Department of Statistic Malaysia (DOSM)
Stock market return (KLCI)	Percentage (%)	KLCI quarterly return	Yahoo Finance

3.3 Research Framework

$$LER_t = \beta_0 + \beta_1 INT_t + \beta_2 LCPI_t + \beta_3 KLCL_t + \beta_4 HM_t + \mu_t$$

Where,

LER = Natural logarithm of MYR/USD (Direct quotation)

INT_t = Lending rate of Malaysia (%)

$LCPI_t$ = Natural logarithm of inflation rate (%)

$KLCI_t$ = KLCI return (%)

HM_t = Hot money changes (%) (Hot money = Net Portfolio Investment + Short-term Cashflow + Net Error and Omissions)

μ_t is the error term being white noise.

Lag length can be determined using Schwarz Criterion (SIC)

The applicability of ARDL model is justified with reference to Nkoro and Uko (2016) stating that ARDL cointegration technique can explain the long run relationship with varying order of integration and further apply reveal the short-run dynamics through Error Correction Model (ECM) (Pesaran et al., 2001). The long run relationship of the underlying variables is detected through the F-statistic (Wald test). In this approach, long run relationship of the series is said to be established when the F-statistic exceeds the critical value band. The approach coupled with Johansen and Juselius cointegration (1990) overcome the weakness of the conventional Granger (1981), and Engle and Granger (1987) cointegration analysis for series integrated of different orders (such as variable-A is I(1) and variable-B is I(0)). However, the presence of integrated stochastic trend of I(2) will render the model ineffective and invalid. The restrictions necessitate the dependent variable to be I(1) despite allowing explanatory variables to make up of mixed order of integration. Unit root tests such as Augmented Dickey-

Fuller (ADF) or Kwiatkowski-Phillips-Schmidt-Shin (KPSS) should be adopted prevailing the estimation to determine the order. The ARDL model explaining exchange rates is developed as follows using quarterly data:

The rationale of cointegration lies in the measures to retain long run information from differenced variables since many time series suffer from non-stationarity at level (contain unit root) which lead to loss of relevant long run properties of the equilibrium relationship. By integrating short run dynamics with long run equilibrium, the model can derive realistic estimates in the pursuit of delivering meaningful forecast and policy implementation (Nkoro & Uko, 2016). The capability to identify cointegrating vectors in the event of multiple cointegrating vectors among variables serves the model well. Granger causality test was applied to assure the existence of long-run bidirectional causality between stock prices and real exchange rates on top of claiming that the latter granger caused the former in the short-run. It concluded the relevance of flow and portfolio-oriented approaches in explaining the variation between the two variables (Türsoy, 2017).

Estimation of ARDL model:

$$\Delta \mathrm{LER_t} = \beta_0 + \theta LER_{t-1} + \theta KLCI_{t-1} + \theta LCPI_{t-1} + \theta INT_{t-1} + \theta HM_{t-1} + \sum_{j=1}^{p} \beta_1 \Delta LER_{t-i} + \sum_{i=0}^{q} \beta_2 \Delta KLCI_{t-i} + \sum_{i=0}^{q} \beta_3 \Delta LCPI_{t-i} + \sum_{i=0}^{q} \beta_4 \Delta Int_{t-i} + \sum_{i=0}^{q} \beta_5 \Delta HM_{t-i} + \mu_t$$

3.4 Data Processing Procedures

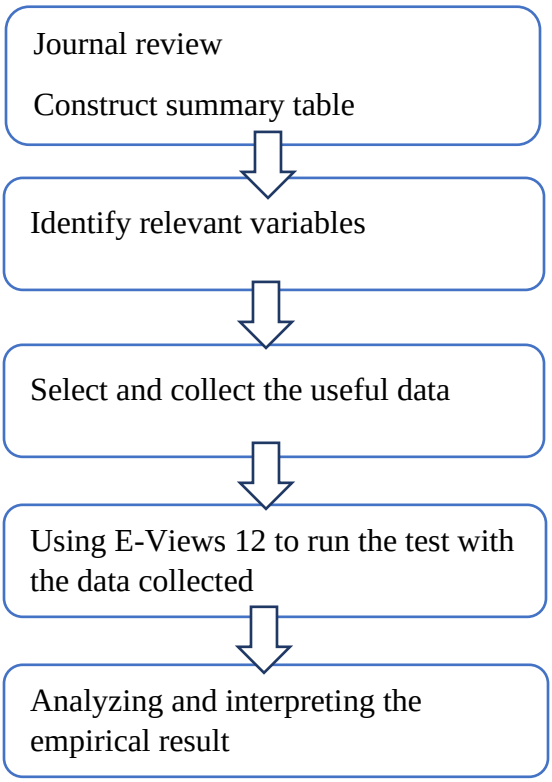


Figure 3.4. Data Processing Process

There are total of five steps in the data processing procedures as shown in the Figure 3.4. First, several journals are obtained from reliable sources for reviewing and identifying relevant variables from previous studies that closely related to this research. At the same time, summary table has constructed to provide an ease of understanding regarding those past studies found. Third, the variables data is collected from the sources like World bank database, BNM, DOSM, Ceic database, and Yahoo Finance. After gathering the quarterly data for each of needed variables, the data will be analyzed by using E-views 12. Last, obtaining the empirical results from the tests and carry out a comprehensive discussion and interpretation.

3.5 Methodology

3.5.1 Unit Root Test

The main goal of unit root test is to determine if each of the variable in this study is stationary or non-stationary. The result enables researchers to better decide which time series model is more suitable for the dataset and study (Peter C. B. Phillips & Pierre Perron, 1988). When the variable is stationary, it means that the mean, variance and covariance are same across different timeframe (Gujarati & Porter, 2009).

The Dickey-Fuller test assumes that error term is not correlated while augmented Dickey-Fuller (ADF) test can be used when the error term is correlated. In fact, ADF test is one of the most popular ways to determine stationarity (Gujarati & Porter, 2009).

Kwiatkowski-Phillips-Schmidt-Shin (KPSS) is a non-parametric test applied in linear regression and the purpose is to examine stationarity of variables surrounding deterministic trend. The series is stated in addition of deterministic trend with random walk and stationary error (Kwiatkowski et al., 1992). Since the possibility of Type 1 error to occur is high in KPSS, this issue can be mitigated by running ADF test in addition to KPSS, and this can ensure that the stationarity result is accurate when the outcomes of both tests are same (Glen, 2016).

Table 3.5.1:

Hypotheses and Decision Rules of ADF and KPSS

	ADF	KPSS
Level	H_0: The variable has one unit root H_1: The variable does not have unit root	H_0: The variable does not have unit root H_1: The variable has one unit root
First difference	H_0: The variable has two-unit root H_1: The variable has one unit root	H_0: The variable has one unit root H_1: The variable has two-unit root
Decision rule	Reject H_0 if t-statistic is higher than test critical value. Otherwise, do not reject H_0.	Reject H_0 if LM test statistic is higher than critical value. Otherwise, do not reject H_0.

3.5.2 ARDL Model

ARDL models evaluates dynamic interactions using time series data. The model's distributed lag component allows the current value of the dependent variable to be contingent on both the current and prior values of other explanatory variables, as well as its own earlier realizations, or the auto regressive aspect. The factors could be fixed, non-stationary, or a combination of the two. The ARDL model, which can also be used to differentiate between long-run and short-run effects, can be used to evaluate a long-run connection between the variables of interest. This is accomplished through the use of its equilibrium correction depiction. This is accomplished through the use of its equilibrium correction depiction. There will be answers to frequently asked questions and a detailed explanation of the Pesaran et al. (2001 Journal of Applied Econometrics) limits test for the presence of a long-run connection.

The post estimation command freshly calculated finite-sample critical values and approximation p-values are used to implement this test. These crucial values replace earlier tabulations that were previously accessible in the literature and span a wide range of model settings. They take into consideration factors such as sample size, lag order selection, number of explanatory variables, and selection of unconstrained or limited deterministic model components. The model is estimated via the ARDL command using Stata's regress tool. As a result, linear (time series) regression specification tests may be performed using the conventional post estimation commands, and dynamic predictions can be produced using the forecast command suite.

3.5.3 Bound Test

Pesaran et al. (2001) developed a cointegration testing method known as the ARDL limits test in the early 2000s. The cointegration bounds test for ARDL contains an additional F-test on the delayed values of the independent variable in ARDL equation. This technique became popular because it avoids the usual constraints of cointegration tests, which say that all variables must be evaluated and integrated in the same order. Many applications have economic factors with varied or uncertain integration orders, so some scholars favour this approach. Complications occur due to the constraints of conventional cointegration tests, such as the Engle-Granger test (1987) or the Johansen test (1991,1995).

H_0: There is no cointegration among the variables.

H_1: There is cointegration among the variables.

3.5.4 Impulse Response Function

According to Elder (2003), impulse response function is used to examine how a shock to one system variable may affect the conditional forecast of another in a model, normally is in vector autoregression model (VAR). To perform impulse response function, the VAR model can be expressed in vector moving average (VMA) representation form in order to smooth the model for short term swing as well as to expose longer-term patterns (Naushan,2021). For instance, the VMA can be as followed $Yt = \mu + \varepsilon t + \emptyset_1\varepsilon_{t-1} + \emptyset_2\varepsilon_{t-2} + \cdots \emptyset_n\varepsilon_{t-n}$. In this situation, the $\emptyset_s$ is interpreted as $\frac{\partial y_{t+s}}{\partial \varepsilon' t} = \emptyset_s$, it indicates that the row i column j element of determines the effects of a one-unit innovation increase in the variable at time t (ε_{jt}) for the value of the variable at time $t + s(Y_{i_{(t+s)}})$, while keeping constant for all other innovations at all dates. The 's' function is representing by $\frac{\partial y_{i\,t+s}}{\partial \varepsilon' jt}$, which is actual impulse response function and holding other variables at t or earlier constant, the ($Y_{i_{(t+s)}}$) explains the reaction to a single impulse in ε_{jt} (Lu & Zhou, 2010). As a result, the impulse response function can help in showing time series model's dynamic behavior in which the model itself unable to do so by tackling how each variable reacts to the system shock (Wilson & Sheefeni, 2014).

3.5.5 Variance Decomposition (VDC)

VDC, also known as forecast error variance decomposition, is applied in macroeconomic analysis to analyse the short-term and long-term relationship between different variables in a vector autoregressive (VAR) model as well as

multivariate analysis. The two most popular methods are principal components and factor analysis, which the latter has been highly utilized in economic forecasting (Lütkepohl, 2010). VDC is used to identify which variables are the main shocks to the dependent variable across different period as time goes. In fact, VDC and impulse responses are applied to identify the variables correlation in a dynamic econometric model as well (Lütkepohl & Kratzig, 2004).

Moreover, VDC can be used to cover the weakness of VECM as VDC could effectively distinguish variables into strong exogenous or endogenous variable, which VECM could not do so (Masih et al., 2010). Exogenous variable might not be impacted by other variables, but endogenous variables could be impacted by other variables in the model. Thus, it is believed that the variable that is primarily influenced by its previous shocks is the most exogenous of all the variables. By using VDC, researchers could determine which variables are weak (follower) and which variables are strong (leader) (Yussuf, 2021).

3.5.6 Granger Causality Test

The objective of Granger Causality test is to determine if two variables has significant causal relationship. It has four possible outcomes, namely Variable A causes Variable B (unidirectional causality), Variable B causes Variable A (unidirectional causality), both variables cause each other (bilateral causality), and no causality relationship (independence). To ensure obtaining stationary variables and uncorrelated error terms, unit root test should be implemented before running the test. If the correlated error terms occurs, suitable transformation must be done. F-test can be applied in Granger Causality test

after regressing the unrestricted model and restrict model (Gujarati & Porter, 2009).

Hypothesis of Granger Causality:

H_0: The dependent variable is not granger caused by the independent variable.

H_1: The dependent variable is granger caused by the independent variable.

Decision rule of Granger Causality:

Reject H_0 if p-value is lower than significant level; otherwise, do not reject H_0.

3.5.7 Diagnostic Checking

3.5.7.1 Normality Test

The fundamental of many of the econometric theory, Classical Linear Normal Regression Model (CLNRM), upholds normality assumption that the error term is normally distributed with bell shape, which indicates that the error term is independent and has constant variance and zero mean value (Gujarati & Porter, 2009). As proposed in Central Limit Theorem (CLT), sample size that is more than 30 is assumed to be distributed normally. According to Chetty (2018) and Menegaki (2019), normality assumption is essential for ARDL model as well.

Jarque-Bera Test is famous normality test due to its skewness-kurtosis combination, it is helpful in constructing time series data if there is possibility

of autocorrelation in the dataset (Bai & Ng, 2005). The ideal values of skewness and kurtosis are 0 and 3 respectively (Gujarati & Porter, 2009).

Hypothesis of Jarque-Bera Test:

H_0: The sample data is normally distributed.

H_1: The sample data is not normally distributed.

Decision rule of Jarque-Bera Test:

Reject H_0 if JB test statistic is greater than critical value; otherwise, do not reject H_0; or

Reject H_0 if p-value is lower than level of significance; otherwise, do not reject H_0.

3.5.7.2 Heteroscedasticity

Based on Gujarati and Porter (2009), one of the main issues with using regression analysis is the existence of heteroscedasticity. A statistical phenomenon known as heteroscedasticity occurs when the standard deviations of the variables are not constant. Both conditional and unconditional heteroscedasticity are possible. Conditional heteroscedasticity is used when future volatility cannot be forecast because of its inherent unpredictable, such as when the values of financial instruments are at stake. When future volatility may be predicted by nature, unconditional heteroscedasticity is employed. The existence of outliers can also lead to heteroscedasticity. An observation that varies significantly from other observations in the sample is referred to as an outlier or an outlying observation. An observation from a population other than the one producing the remaining sample observations is referred to as an outlier.

Regression analysis findings can be significantly changed by including or excluding the outlier, especially in small sample size.

Heteroscedasticity issue can be determined by formal and informal methods. The graphical method is a popular informal technique for identifying heteroscedasticity issues. In other words, the goal is to identify heteroscedasticity issues using a hypothetical graph of predicted square residual patterns. The formal method for identifying heteroscedasticity is hypothesis testing. Breusch-Pagan-Godfrey test, Glesjer test and Park test are some examples of formal method, while Breusch-Pagan-Godfrey test are being adopted to identify heteroscedasticity issue in this research (Gujarati & Porter, 2009).

Generalized least square or weighted least square can be used to resolve the heteroscedasticity issue when the error variance is known. Heteroscedasticity has no influence on the unbiasedness and consistency properties of the OLS estimators, but they are no longer useful. The researcher can re-estimate the model using Generalized Least Squares to obtain the necessary covariance, T-statistics, and a new set of estimated parameters that would be more efficient than OLS estimator (Gujarati & Porter, 2009).

3.5.7.3 Autocorrelation

Gujarati and Porter's (2009) define autocorrelation as the association between the error term for one observation and another observation. In other words, autocorrelation refers to the correlation between a particular observation's variables at different points in time when discussing time series data. Cross-sectional data represents a correlation between the variables of specific

observations taken in separate places. Pure autocorrelation and impure autocorrelation are the two forms of autocorrelation. Pure autocorrelation occurs when uncorrelated observations of the error component are included in an appropriate specification equation, as opposed to impure autocorrelation which occurs when the model is poorly stated. There are several causes for autocorrelation in the model such as researcher using an incorrect functional form, omitting important variables, or having problems with the model's data (Gujarati & Porter, 2009).

When there is an autocorrelation issue, the OLS estimator will have certain implications. Although the OLS estimators continue to be fair and consistent, they will eventually lose their effectiveness since the variance will no longer be at its lowest level. Due to the OLS method's potential under- or overestimation of the variance, it might render all hypothesis testing incorrect (Gujarati & Porter, 2009). There are two methods the researcher might employ to find the model's autocorrelation issue. A graphical technique is used for informal testing, whereas the Durbin-Watson test, Breusch-Godfrey LM test, and Durbin's h test are used for formal testing. The Breusch-Godfrey LM test may be used in this study's model to identify an autocorrelation issue utilizing time series data. In addition, there are a few different sorts of corrective measures to deal with the model's autocorrelation issue. When there is a pure serial correlation, the researcher can apply Generalized Least Squares to alter the model. Meanwhile, when the model has a higher sample size, some researchers can also employ Newey-West standard errors

3.5.7.4 Model Specification Test

According to Gujarati and Porter (2009), the likelihood of model specification mistake is considerable when a model includes or excludes significant and

relevant variables, chooses the incorrect sample, applies the incorrect functional form, or makes a measurement error. It should be noted that leaving out a crucial variable will have a more significant effect than adding a trivial one to the model. OLS estimators will still be unbiased and consistent when a trivial variable is added to the mode, but they will turn biased and inconsistent when a crucial variable is left out of the model. The OLS estimators will no longer have a minimal variance, which means they are no longer the best estimators, according to a model specification mistake. When a model is not specified, all hypothesis testing and the model itself are rendered invalid.

Ramsey (1969) introduced the Regression Equation Specification Error Test (RESET) which is a general test of specification error. The work done with the aid of the values from the F-critical distribution forms the basis of the Ramsey's RESET test. The existence of heteroscedasticity and the autocorrelation problem cannot be overcome, and the model must be corrected if the Ramsey's RESET test findings show a model specification error. The model's heteroscedasticity and autocorrelation difficulties, however, are not a problem if the results of the Ramsey's RESET test show that there is no model specification error.

In this study, the model specification is erroneous if the null hypothesis is rejected, and vice versa. Researchers can change the form of the model into another form, such as a log-lin model, lin-log model, or log-log model, which may assist to correct the misspecification. It may be necessary to add or remove variables from the model if the specification mistake in the model persists.

3.5.7.5 Stability Test (CUSUM/CUSUMSQ Test)

Stability tests are used to assess both the stability of error correction models and the likelihood of structural failure. Nowadays, the OLS method's CUSUM of square test is widely used since its computation is simple (Ploberger and Kramer, 1992).

While the cumulative sum of square test is intended to demonstrate rapid changes in coefficients of regression, the cumulative sum test is used to demonstrate systematic changes in coefficients of regression. This testing is not flawless, though. If there is a serial correlation issue with the data set, the CUSUM result about model stability will be inadequate and deceptive. As a result, there exist several sorts of estimators to assess the model's stability, such as CUSUM and CUSUMQ. They all have the capacity to assess the model's stability, although under various conditions. For instance, the CUSUM test will be a better estimator than the CUSUMQ test whenever a data set has a structural break or constant term (Andrew, 1993).

CHAPTER 4: DATA ANALYSIS

4.1 Introduction

This chapter discusses the output of tests mentioned in Chapter 3. Unit root tests, namely ADF and KPSS, are adopted in order to understand the property of dependent

and independent variables in terms of their stationarity. The optimal lag number in ADF test and KPSS are determined by Schwarz Information Criterion (SIC) and Newey-West Bandwidth respectively. After passing the prerequisite test, long-run test is being run using ARDL test to study the relationship between Malaysian Ringgit exchange rate and the factors, namely lending interest rate, inflation rate, hot money and KLCI return. Subsequently, diagnostic tests such as Jarque-Bera test, Breusch-Pagan-Godfrey, Breusch-Godfrey Serial Correlation LM, Recursive Estimation, CUSUM and CUSUM square. Finally, short-run integration is being explored via impulse response function and variance decomposition output, while short-run causality is being testing via granger causality test.

4.2 Unit Root Test

Table 4.2.1:

ADF Test Output

	ADF			
	Level form		First difference	
Variables	**Intercept**	**Trend with intercept**	**Intercept**	**Trend with intercept**
LER	-0.4471 (0)	-2.6058 (0)	-6.3550 (0)***	-6.4021 (0)***
KLCI	-7.5215 (0)***	-8.9533 (0)***	-	-
LCPI	-0.6319 (0)	-1.8047 (0)	-7.5003 (0)***	-7.4532 (0)***
INT	-2.3687 (1)	-5.1536 (7)***	-3.0429 (0)**	-2.9969 (0)
HM	-7.5284 (0)***	-7.7177 (0)***	-	-

Table 4.2.2:

KPSS Test Output

	KPSS			
	Level form		First difference	
Variables	Intercept	Trend with intercept	Intercept	Trend with intercept
LER	0.6998 (6)**	0.1203 (5)*	0.2120 (0)	0.1106 (1)
KLCI	0.7231 (2)**	0.1177 (3)	-	-
LCPI	0.8838 (6)***	0.1886 (5)**	0.0926 (3)	0.0718 (3)
INT	0.5494 (5)**	0.1035 (5)	0.0786 (3)	0.0704 (3)
HM	0.2070 (0)	0.0408 (0)	-	-

Note: *, **, *** represent the significance at 10%, 5%, and 1% levels, respectively. Number of lags is stated within the parentheses. The optimal lag number in ADF test and KPSS are determined by SIC and Newey-West Bandwidth respectively. The null hypotheses in ADF is the presence of unit root while null hypotheses in KPSS is the presence of stationary.

The reason of using both ADF and KPSS is to verify the result of each other. Generally, if the result of ADF is conflicting, the result of KPSS could be used to conclude the result.

LER and LCPI have one unit root. In ADF level form test, it shows that LER and LCPI have one unit root as null hypothesis is not rejected; in ADF first difference test, it shows that LER and LCPI do not have two-unit root as null hypothesis is rejected. This indicates that both LER and LCPI have a unit root and is not stationary, and KPSS results provided the same conclusion.

KLCI and HM have no unit root. In ADF level form test, p-value is lower than all significant level; thus, null hypothesis is being rejected. In KPSS level form test, the null hypothesis is not being rejected as LM test statistic value is lower than critical values at all significant level. In the KPSS level form test of KLCI, although null

hypothesis could only be rejected at 1% significant level, it is reasonable to conclude that KLCI does not have unit root based on the solid ADF test result.

INT has one unit root. In both ADF and KPSS level form test, there is conflicting result as intercept test showed that there is one unit root while trend and intercept test indicated that there is absence of unit root. Therefore, first difference test is proceeded, and it can be concluded that INT has one unit root at all significant level.

There are three variables without unit root and three variables with a unit root. Therefore, ARDL could be proceeded for long-run test.

4.3 Long Run Relationship

The validation of a mixed order of integration of 0 and 1 for all variables permits the use of ARDL model to test the long run association and the existence of systemic co-movement in the long run by applying cointegration test subsequently. The significance of cointegration lies in its ability to detect and confirm the likelihood of spurious correlation among the variables (Singhal, Choudhary & Biswal, 2019).

In ARDL model, the strict rule on lag structure necessitates the use of SIC (Schwarz Criterion) to confirm that the maximum lag length is 4. It is widely acknowledged that the lag length can vary across the universe when each variable is treated as dependent variable respectively. The estimated model is expressed as ARDL (1,0,0,0,1) where only exchange rate as the dependent variable and equity index is accompanied with 1 lag each. Results of ARDL Bound test are presented in Table 4.3.1. Stock market return

(KLCI) exhibits negative relationship with exchange rate at 1% significance level while hot money concluded to positively influence at 5% significance level. The negative relationship suggests that strengthening stock market return will lead to a dampening effect on exchange rate, in which the home currency will appreciate. On the contrary, exchange rate is expected to move in tandem with hot money such that an uptick in short term capital net flow will contribute to devaluation of home currency as the quotation rises. While the rest of the variables are insignificant to confirm the sign and magnitude of the expected relationship with exchange rate.

Cointegration exists when the speed of adjustment coefficient appears to be negative, of which the coefficient 0.962478 shown in the result, indicates that exchange rate converges to long-run equilibrium over time (Ibarra, 2011) by 96.25% per quarter. Long run equilibrium can be confirmed using the F-test for the combined significance of the coefficients of the lagged values of the variables. The lower and upper critical bounds are formed on the basis of I(d) (where $0<d<1$) derived under the premise that all regressors are I(0) and purely I(1), respectively. The conventional manner of hypothesis testing is followed where null hypothesis is preferably to be rejected, whereas the case of test statistics swings within the band will yield inconclusive result (Lin, 2010). Referring to the Table 4.3.1, the result yields a meaningful result confirming the convergence in the long run given that the F-statistic (11.40) lies way above the upper asymptotic critical value bound, thus rejecting the H_0 of no long run relationship. This explains the behavior of exchange rate whenever there is a shock in the system, such that it will move in either direction following the move of independent variables. It is not independent in the long run in a sense that the impact on exchange rate is always observed post movement of other variables. Estimation results for the selected ARDL model is shown in the equation below based on automatic selection of 4 lags dependent variable and 4 lags for regressors. The optimal lag length is based on the SIC criterion with the maximum lag length found to be 4.

Summarize equation:

$$\mathrm{D(LER)} = -0.0085\ \mathrm{D(INT_{t-1})} + 0.8069\ \mathrm{D(LCPI_{t-1})} + 0.0015^{**}\mathrm{HM_{t-1}}$$

$$-0.1650\mathrm{KLCI}^{***} - 0.0792^{**}\mathrm{KLCI_{t-1}} + 0.0030 + \sum_{t=1}^{n} DLER_{t-n}$$

F= 0.0727

$$+\sum_{t=1}^{n} DINT_{t-n} + \sum_{t=1}^{n} DLCPI_{t-n} + \sum_{t=1}^{n} DHM_{t-n} + \sum_{t=1}^{n} DKLCI_{t-n}$$

F= 0.4906 F= 1.5149 F= 6.7778** F= 13.7506***

Table 4.3.1:

Estimation Result for Bound Test

k = 4, Finite Sample: n = 53	**Wald F-statistics**	11.4031***

Note: Given 53 observations, critical values for bound test are obtained from Narayan (2005) assuming restricted intercept and no trend

Table 4.3.2:

Estimation Result for Diagnostic Test

Test	**Critical Value**
Jacque Bera Test	2.160262
Breusch-Pagan-Godfrey Test	0.119028
Breusch-Godfrey Serial Correlation	1.616933

Note: *, **, *** represent the significance at 10%, 5%, and 1% levels, respectively.

4.4 Diagnostic Tests

4.4.1 Normality Test

The normality test is used to test the normality of the error terms in the model. From the result in Table 4.3.2, the error terms of the model are normally distributed.

4.4.2 Heteroskedasticity Test

Breusch-Pagan-Godfrey test had been applied in this study to identify heteroskedasticity issue. The outcome in Table 4.3.2 shows that there is no heteroscedasticity issue.

4.4.3 Breusch-Godfrey Serial Correlation LM Test

Breusch- Godfrey Serial Correlation LM Test is being adopted in this study to test the autocorrelation problem of the model. The result in Table 4.3.2 shows that there is no autocorrelation problem as the null hypothesis is not being rejected at 5% significant level.

4.4.4 Model Specification Test: Recursive Estimates

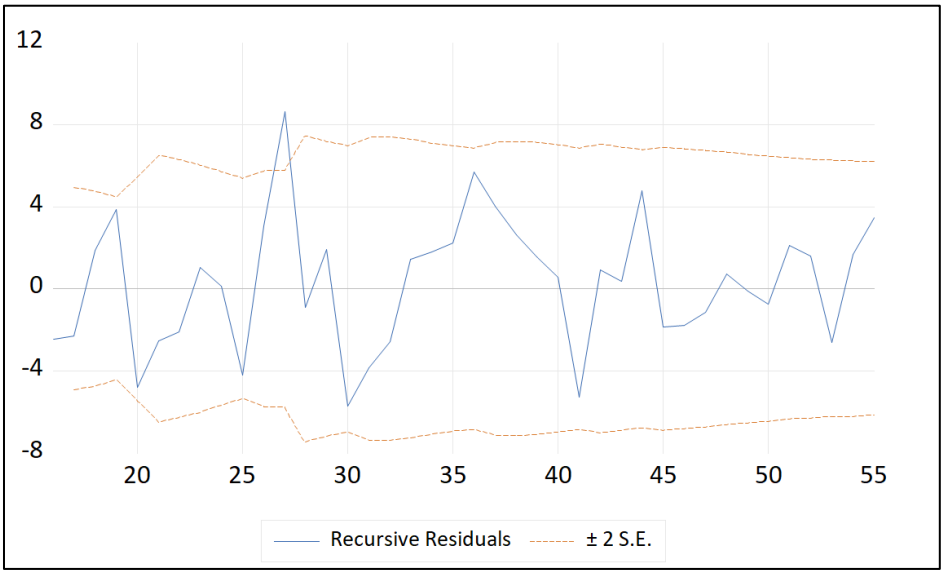


Figure 4.4.4. Recursive Estimates

Based on Figure 4.4.4, the recursive residual statistics can be seen to fall between the confident intervals. Therefore, the data set of this research is concluded to be successful.

4.4.5 Stability test: CUSUM & CUSUM square test

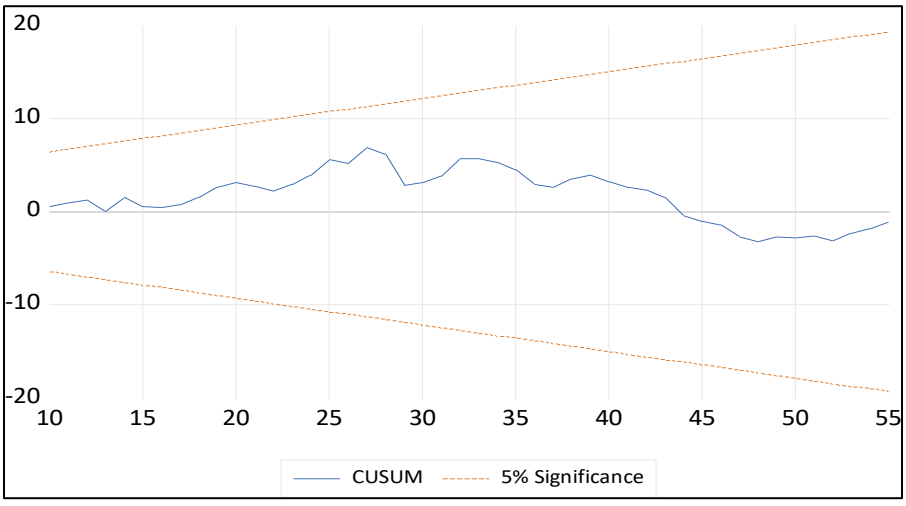


Figure 4.4.5.1. CUSUM Test

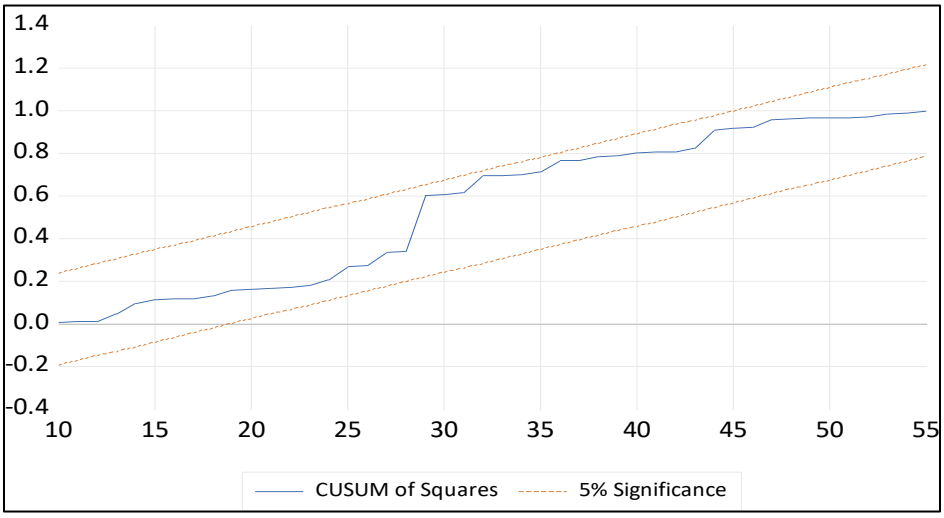
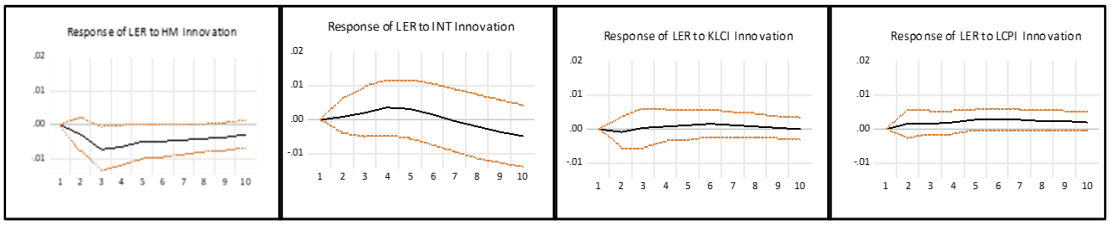


Figure 4.4.5.2. CUSUM Square Test

CUSUM and CUSUMSQ Test are applied to this study to the whether the model is constant. Figure 4.4.5.1 and Figure 4.4.5.2 show that the model is constant since the CUSUM and CUSUMSQ statistics value is within the range of 5% significant level.

4.5 Short Run Dynamics

4.5.1 Impulse Response Function



A *B* *C* *D*

Figure 4.5.1.1. Impulse response function output of LER to independent variables

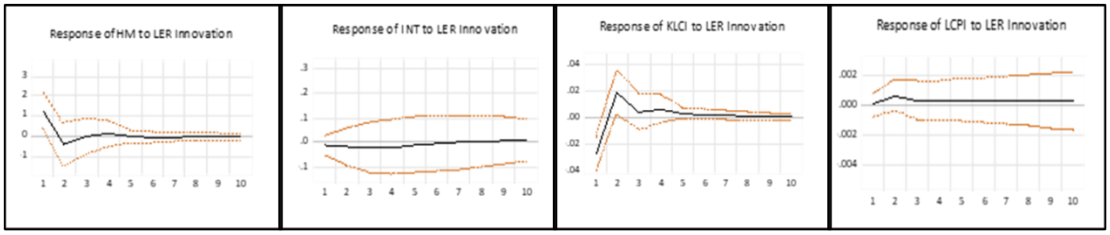
The Figure 4.5.1.1A shows a permanent negative effect of hot money shock to exchange rate. The effect of shock starts to raise under negative condition from period three. However, since the confidence interval has included zero which leads to inconclusive negative shock.

The Figure 4.5.1.1B shows a temporary positive shock of interest rate to exchange rate at the first half of overall period. The effect of shock is less after period five. Then, die out at between the period six and period seven as the shock has converged to zero. However, the temporary positive effect cannot be concluded as the zero has included in confidence interval.

The Figure 4.5.1.1C shows the KLCI shock has no influence on exchange rate since its effect of shock is closely to zero over the period. However, the shock cannot be concluded due to the confidence interval consist of zero.

The Figure 4.5.1.1D shows a permanent positive effect of consumer price index shock to exchange rate. The effect of shock has increased slightly before period five. Then it

remains constant between period five and seven and decline gradually. However, the positive shock result in inconclusive due to the confidence interval has included zero.



A *B* *C* *D*

Figure 4.5.1.2. Impulse response function output of independent variables to LER

The Figure 4.5.1.2A shows a temporary positive exchange rate shock towards hot money at initial. The effect of shock become fluctuating negatively and positively between period two and eight. Then, back to normal afterward.

The Figure 4.5.1.2B shows there is a negative exchange rate shock towards interest rate. The effect of shock starts to raise after period three and the shock converges back to normal after period six.

The Figure 4.5.1.2C shows there is a negative short term exchange rate shock towards KLCI returns. The negative effect of shock starts to become positive after period two and then gradually back to normal.

The Figure 4.5.1.2D shows a permanent positive exchange rate shock to consumer price index. Between period two and four, there is a slight declining effect of shock. Then, the shock remains constant that closely to zero after period four.

4.5.2 Variance Decomposition Output

Table 4.5.2.1:

Variance Decomposition of LER

Period	HM	INT	KLCI	LCPI
1	0.0000	0.0000	0.0000	0.0000
2	1.7969	0.1840	0.1815	0.4164
3	9.3720	0.8329	0.1468	0.7463
4	12.9227	2.1831	0.2393	1.0558
5	14.5795	3.0069	0.3936	1.7429
6	16.1348	3.0305	0.5792	2.4717
7	17.5300	2.9016	0.7014	3.0680
8	18.4716	3.2545	0.7486	3.5455
9	18.9213	4.4715	0.7435	3.9197
10	18.9504	6.5849	0.7154	4.1974

Table 4.5.2.2:

Variance Decomposition of HM, INT, KLCI and LCPI

Period	HM-LER	INT-LER	KLCI-LER	LCPI-LER
1	14.5225	0.5621	30.0507	0.0917
2	14.3979	0.5520	34.8653	2.9369
3	13.9198	0.6527	34.8204	2.3867
4	13.8929	0.6622	35.2631	2.2124
5	13.7973	0.6100	35.4451	2.2182
6	13.7451	0.5589	35.5397	2.1219
7	13.6646	0.5329	25.5161	2.0079
8	13.5758	0.5353	35.4270	1.8822
9	13.5047	0.5618	35.3102	1.7473
10	13.4558	0.6013	35.1982	1.6093

Referring to Table 4.5.2.1, the contribution of variables like hot money, interest rate, KLCI returns, CPI to exchange rate has increased moderately from period to period. The hot money has risen sharply at between period two and three, and then moderately afterwards. It has contributed much among the variables at around 18%, which is the highest contribution of variables towards exchange rate. While the contribution of interest rate, KLCI returns, and CPI are lesser although they have a slight increase over the period. In short, it may conclude that hot money is the most significant element that impact the exchange rate based on variance decomposition.

Referring to Table 4.5.2.2, the variance decomposition output of the variables other than exchange rate. The contribution exchange rate to hot money has decreased slightly over the period from around 14% to 13%. Besides, the output demonstrates that the exchange rate has a small contribution to interest rate over the period at around 0.6%. Moreover, KLCI returns that contributed by exchange rate has increased moderately before the first half period, then declined slightly afterwards, but it is still in the highest value of contribution at around 35%. Additionally, the contribution of exchange rate to CPI has risen sharply from period one to two, then declined straightly over the period from 2.94% to 1.61%. With these findings, the exchange rate can be concluded that it has most influence on KLCI returns.

4.5.3 Granger Causality

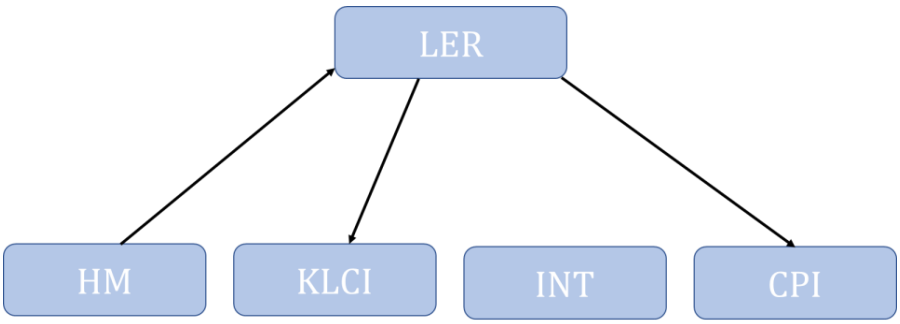


Figure 4.5.3: Granger Causality Summary

From Figure 4.5.3, there are only three unidirectional causalities being found which are hot money, KLCI returns and CPI. The finding shows that the exchange rate is granger caused by hot money whereas the KLCI and CPI is granger caused by the exchange rate. However, interest rate has no granger causality with exchange rate.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.1 Introduction

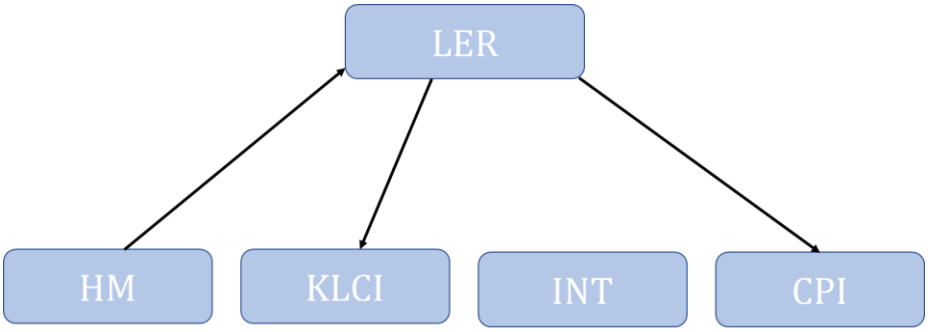
This chapter involves a comprehensive explanation of the main conclusions of the findings and output of this study. The research objective is to study if Malaysian Ringgit exchange rate will be influenced by lending interest rate, inflation, hot money and stock market return. Impulse response function, variance decomposition and granger causality and are applied for studying short-run relationship while ARDL is applied for studying long-run relationship. To sum up this study, implications, limitations and recommendations will be elaborated.

5.2 Summary of Statistical Analysis

5.2.1 Summary of Granger Causality

Figure 4.5.3:

Granger Causality Summary



From Figure 4.5.3, there are only three unidirectional causalities being found which are hot money, KLCI returns and CPI. The finding shows that the exchange rate is granger caused by hot money whereas the KLCI and CPI is granger caused by the exchange rate. However, interest rate has no granger causality with exchange rate.

5.2.2 Summary of ARDL model

Table 5.2.2:

ARDL Output Summary

No.	Null Hypothesis	Coefficient	P-value	Decision
1.	H_0: There is an insignificant relationship between interest rate and the Malaysian Ringgit exchange rate	-0.0085	0.4872	Insignificant negative relationship
2.	H_0: There is an insignificant relationship between consumer price index and the Malaysian Ringgit exchange rate	0.8069	0.2247	Insignificant positive relationship
3.	H_0: There is an insignificant relationship between stock market return and the Malaysian Ringgit exchange rate	-0.1650	0.0000	Significant negative relationship
4.	H_0: There is an insignificant relationship between hot money and the Malaysian Ringgit exchange rate	0.0015	0.0124	Significant positive relationship

5.3 Discussions of Major Findings

5.3.1 Interest Rate

From the result obtained in this study, lending interest rate is negatively and insignificantly related to Malaysian Ringgit exchange rate against U.S. Dollar

in both short term and long term, indicating that when lending interest rate rises, Malaysian Ringgit value will appreciate. However, the insignificant relationship discovered this study suggests that interest rate is not an important factor for determining Malaysian Ringgit exchange rate. Besides, this study has also proven that there is no granger causality between interest rate and Malaysian Ringgit value.

This result is consistent with many other researchers such as Grauwe (2000), Wilson and Sheefeni (2014), Wan Mohd Yaseer Mohd Abdoh et al. (2016), Hashcyshyn et al. (2020) and Ng and Caroline Geetha (2020) who discovered insignificant relationship between the two variables. Based on Grauwe (2000), currencies of developed countries in the U.S. and Europe are not related to interest rate. Hashcyshyn et al. (2020) explained the significance of relationship between the two variables varies according to status of wages and monetary freedom of a country. In developing countries like Malaysia, the wages and monetary freedom is relatively low; thus, the relationship of the two variables is weak. In addition, Har et al. (2017) suggested that financial innovations entice investors to invest in non-interest-bearing securities due to better perceived risk-and-return ratio; thus, interest-bearing securities is less popular than before, making interest rate to be an insignificant factor towards Malaysian Ringgit value.

Despite interest rate change could affect currency value according to traditional theories, there are other factors that have larger influencing power towards the Malaysian Ringgit value in the current highly globalized world where information could be quickly obtained (Frieden, 2008). There are too many noises that affect consumption patterns and investors' investment analysis and decision. Nowadays, many retail investors with less experience could invest in foreign stocks, causing currency demand to be even more uncertain. Thus, this study suggested that the effect of lending interest rate on Malaysian Ringgit

value is insignificant as there are other determinants that make the effect of interest rate to become weak.

On the other hand, the long-term and short-term insignificant relationship found in this study is contradictive with IRP theory and IFE theory, which state that interest rate increment will lead to home currency value depreciation (Zhang & Dou, 2010; Puci & Mansaku, 2016). Previous researchers such as Dekle et al. (2002), Anita Mirchandani (2013) and Tariq Mahmood Ali et al. (2015) have concluded that interest rate is significantly related with exchange rate. Moreover, this study proves that interest rate does not granger cause Malaysian Ringgit exchange rate, which is as opposed to Dhamotharan and Mohd Tahir Ismail (2015a) who suggested that there is strong causal relationship between the Malaysian Ringgit exchange rate and the nominal interest rate difference against the U.S. as the rise in interest rate tend to entice investors to invest in the country, which could improve the Malaysian Ringgit demand (Anita Mirchandani, 2013).

5.3.2 Inflation Rate

From the finding of this study, it indicates the inflation is positively but insignificantly related to exchange rate. In other words, when inflation rate increases, Malaysia Malaysian Ringgit will depreciate. However, these two variables are being concluded as no relationship due to insignificant result. This result is consistent with Ng and Caroline Geetha (2020) who have found out insignificant relationship between inflation rate and exchange rate in the context of Malaysia. The researchers claimed that their result was different from their expectation which might be due to the study's limitations, and they believe that

future research should look more closely at inflation as it still a crucial factor that can affect the economy and the exchange rate.

In contrary, this study is opposed to some studies conducted by Anita Michandani (2013) and Fadli Fizari Abu Hassan Asari et al. (2011). They have discovered an expected finding, which is significant and negative relationship. It means a nation's exchange rate will depreciate if high inflation occurs. This is owing to the general rules that if a country that consistently experience lower inflation, the exchange rate will be appreciated caused by the rising purchasing power from domestic and foreign consumers and vice versa.

From the short run finding tested by granger causality, it is consistent with Samuel Antwi et al. (2020) who have implied the exchange rate is not granger caused by inflation rate. However, the exchange rate will granger cause the inflation rate which has founded in this study. This means that only exchange rate's history value can use to anticipate the current value of inflation rate. Yet, this finding is still opposed to Tariq Mahmood Ali et al. (2015) whose finding has indicated a bidirectional causality between them.

In a nutshell, the obtained of insignificant result has implied inflation has no relation with exchange rate although it has expected sign of relation which may be due to the meaning of inflation on exchange rate has changed. In 18th century, inflation has used to describe when the currencies lost their value, while in 19th century has used to refer prices effect. But nowadays, the term of inflation demonstrates the changes in market circumstance with any causes for pricing increase. Thus, the diminished purchasing power has no longer relate to the currency as it seems like shortages caused by insufficient production with high prices when increasing input prices (Levine,2023).

Furthermore, in current years, some trade of goods and services between Malaysia and some countries such as Thailand and Indonesia have implemented local currency settlement (Bank Negara Malaysia, 2019). This indicates the trade transaction will not involve U.S. Dollar anymore. Instead, they can exchange own local currency to the counterparty's currency directly, without converting to U.S. Dollar beforehand. By doing so, it can manage both countries' currency risk effectively as well as reducing the country's inflation. For instance, in traditional trade, Malaysia importers who buy goods from other countries must convert Malaysian Ringgit to U.S. Dollar, then transfer the converted U.S. Dollar to the counterparty. Due to depreciation of Malaysian Ringgit, more Malaysian Ringgit is needed to buy one U.S. Dollar. Hence, the price level of goods in Malaysia may rise due to high cost of import. However, local currency settlement need not to go through the currency conversion with U.S. Dollar, which helps to reduce the dilemma faced as mentioned above. In short, the exchange rate in this study has no relation with inflation which may be due to the trend of international trade agreements that causes the outcomes to have changed from traditional trade condition.

In addition, another reason may be inflation has no direct impact on exchange rate. According to Tariq Mahmood Ali et al. (2015), their research had concluded that high money supply raise inflation problem due to rising price level. Such then, it may impact the exchange rate changes. From this study, it can be viewed as the inflation effect on the exchange rate is indirectly since its impact is being triggered by other factors.

5.3.3 Hot Money

The result obtained suggests a positive significant relationship between hot money and exchange rate, such that an increase net short term capital inflow will induce Malaysian Ringgit value to weaken. Furthermore, this study supports unidirectional causality from hot money to exchange rate but fails to proof the other way round.

The result is consistent with studies of Karahan and Colak (2019), Edwards and Rigobon (2009), Roya and Kemme (2020) and Ye and Zhang (2018) justified by the adjustment in the current account induced by the reduced capital inflow, hence stimulates the depreciation in home currency. However, the spillover transmitted to the economy to cause a domestic credit boom and subsequent crisis due to risk mispricing and run up in asset prices which is evidenced by the above studies in the context of Turkey and Thailand. Moreover, Ye and Zhang (2018) affirmed the role of U.S. quantitative easing causing influx of international capital which expedites exchange rate appreciation.

In contrast, there is inconsistent result coming from studies of Gamze Şekeroğlu and Melek Acar (2020), Boudias (2015), Combes et al. (2012) and Ibarra (2011) claiming that hot money catalyses the demand for home currency hence imposing a downward pressure on exchange rate, worsening the local competitiveness. It is suggested that floating exchange rate regime is flexible and effective in stabilizing an upward bias on currency appreciation when there is capital inflow by not causing any other nominal impact. Combes et al. (2012) revealed portfolio investments tend to encourage strength of home currency the most in emerging and developing countries. While Ibarra (2011) claimed that FDI having the largest impact. The adjustment is attributed to the fact that home

currency appreciation happens to restore equilibrium or offset current account deficit when the inflows not accumulated as reserves.

On the other hand, Kodongo and Ojah (2012) countered that the high volatility and weak persistence of foreign portfolio investments make any connection between the two insignificant. In addition, the short run dynamics is inconsistent with the past research by Li, et,al. (2018) who found bidirectional that even though there is positive influence at some point but the impact is not consistent owing to changing productivity, economic openness, and oil price shocks in China.

Moreover, the role of hot money is time-varying and to some extent being mediated by other factors. Lee et al. (2017) concluded that hot money influences exchange rate in the low quantiles while a focus in China context suggested that Shanghai and Shenzhen stock markets receives the impact in high quantiles. Duarte and Stockman (2004) claimed that speculation drives the variability in risk premia which spread across foreign exchange market without affecting other macro variables. In addition, net equity flows towards the U.S. from developing countries tend excite exchange rate volatility as opined by Grossmann and Orlov (2022) due to market wide perception of being a capital flight. Hence, it can be inferred that hot money renders significant impact on the exchange rate and the importance of exchange rate regime in managing credit growth.

5.3.4 Stock Market Return

A positive increase in the stock market will result in an increase in the value of the Malaysian Ringgit, according to the study's finding that there is a negative

substantial connection between stock market return and exchange rate. Furthermore, unidirectional causality is observed running from exchange rate to stock market return (KLCI) vice versa, which is consistent with the portfolio balance model described above.

The result is consistent with the studies by Walid Chkili and Duc Khuong Nguyen (2014), Tule et al. (2018), Grossmann and Orlov (2022) and Zeng et al (2022) grounded on the belief that transmission mechanism plays important causing exchange rate to stay below equilibrium as a boom in market sentiment encourage home currency conversion by making the equity investment more attractive. Walid Chkili and Duc Khuong Nguyen (2014) opined that stock market positively influences exchange rate in Brazil and India which increase in strength when the market experiences high volatility. Moreover, Zhao (2010) evidenced absence of long run relationship between RMB real effective exchange rate and stock price due to China government intervention in a managed floating exchange rate regime. Since foreign exchange reform in China in 2005, Zeng et al. (2022) evidenced the presence of systematic risk spillover and volatility spillover between the two variables.

On the contrary, Tsai (2012), Grangera et al. (2000) and Lin (2012) had inconsistent result claiming that pessimism in the stock market induces capital reallocation to seek better risk-adjusted return rendering lower demand for home currency. It is found that the impact enlarges during episodes of extremely high and low level of exchange rate in the Asian markets (Tsai, 2012).

In fact, short run dynamics is inconsistent with findings of Grangera et al. (2000), Abdulnasser Hatemi-J and Eduarda Roca (2005), Seyfettin Erdoğan et al. (2020) and Gaurav Agrawal et al., 2010). Moreover, the study yielded results contradict with Zhao (2010) and Liu and Wan (2012) who reported insignificant relationship between exchange rate and stock market. Lin (2012) claimed that

crisis contributes to greater cointegration between them in Asian emerging markets which is consistent with contagion effect between asset prices. Hence, it can be inferred that stock market return exerts a direct impact on the exchange rate especially in times of extreme economic turbulence and financial instability.

5.4 Implications of Study

This study provided some insights that are rather novel as compared to the previous studies as it is proven that in both short term and long term, fundamental factors such as interest rate and inflation rate are insignificantly related with the Malaysian Ringgit exchange rate, which is consistent with study carried out by Grauwe (2000) for currencies in major countries such as U.S. Dollar, Euro, pound sterling and so forth. In current world, capital has a stronger relationship with the Malaysian Ringgit exchange rate, which is indicated by the hot money change and KLCI return in this study. Thus, this part discusses about the implications regarding how policy makers, investors, traders and academicians could utilize this study in their strategy and analysis.

5.4.1 Policy Makers and Government

As the BNM controls Malaysian Ringgit value via managed floating exchange rate regime, it is essential for to have a significant and up-to-date model to forecast the Malaysian Ringgit movement, which can be found in this study. The outcome in this study implied that interest rate and inflation rate are no longer significant to affect Malaysian Ringgit exchange rate as the world has been changing and there are many interferences of external factors and uncertainties. Hence, is it essential for policy makers to solve current issue with

new determinants to prevent wastage of resources and to tackle problems effectively.

BNM has been rising the interest rate gradually since May 2022, but the improvement in Malaysian Ringgit exchange rate against U.S. Dollar is not as effective as expected, which indicates that there are other factors that could be more effective to improve Malaysian Ringgit value. With this study, the BNM and government can come out with more appropriate policies to ensure that the floating exchange rate does not fluctuate significantly to the extent that will bring a huge impact to import, export and foreign investment. If it is predicted that there will be a significant event happening soon, BNM and government can prepare for contingency plan to tackle the crisis. This can help Malaysia to be resilient and sustain economic growth. Thus, policy makers can use the model in this study, and focus on hot money and KLCI return in order to make accurate forecast.

Since hot money is a crucial variable for determining Malaysian Ringgit exchange rate against U.S. Dollar, this study suggests that a rise in hot money changes will depreciate Malaysian Ringgit value. Asian financial crisis happened in 1997 was caused by capital flow, which there was huge capital outflow from Malaysia financial market, causing Malaysian Ringgit value to devalue significantly. Thus, policy makers and government have to pay extra attention on hot money flow in to and out of Malaysia in order to prevent the occurrence of financial crisis again.

5.4.2 Investors and Traders

Traders in foreign exchange market used to focus on inflation rate and interest rate in forecasting the movement of Malaysian Ringgit exchange rate, but this study suggests that traders could focus more on financial variables such as hot money and stock market return instead as the current market condition is no longer same as the traditional market in decades ago. They could form a better model to predict the Malaysian Ringgit exchange rate in order to make more informed and rational trading decision. Portfolio managers could also make Malaysian Ringgit exchange rate forecast based on this study so that they could adjust their portfolio or do hedging by monitoring the changes in hot money and stock market return. This enables the investors and traders to make better risk management too.

Moreover, normal corporations that involve in international trade and business can better forecast the Malaysian Ringgit exchange rate against U.S. Dollar using hot money and stock market return in their model in order to reduce losses caused by exchange rate fluctuations.

5.4.3 Academic Researchers

Previously, there are very limited studies on how hot money and stock market return affect Malaysian Ringgit exchange rate. This study has provided an up-to-date insight on the determinants of Malaysian Ringgit so that the academic scholars could use it as a reference and expand their studies based on this paper. It is worth noting that interest rate and inflation rate is no longer significantly related to Malaysian Ringgit exchange rate in current world, which contrasts with the traditional theories such as IRP, IFE and PPP. With this, the academic

researchers might be interested to study what are the other factors that will significantly related to Malaysian Ringgit exchange rate, other than hot money and stock market return that have been proven in this study.

5.5 Limitations of Study

Throughout this study, it has provided various useful information for relevant parties such as policy makers, investors, and scholars. Nevertheless, every research has inherent limitations that researcher could not avoid. Hence, this study also consists of some limitations that need to be focused on future research for generating an ideal result.

Firstly, there is a limited amount of free data available which causes some relevant data or information cannot be obtained successfully. For instance, there are many types of interest rate can be chosen to determine its effect on exchange rate. One of the reasons that the lending interest rate was being selected rather than other types in this study is because it is unable to access others' data freely in this study. Nevertheless, the lending rate in this study still plays a critical role as an attractive lending rate will encourage more lenders which turns in impacting the exchange rate as well.

Secondly, this study used limited independent variables to avoiding econometric model problems. Other than the four independent variables selected for this study, there are still various financial and macroeconomic variables that can influence the Malaysian Ringgit exchange rate. Even though this study can provide the overall model significance and some expected result from each variable, future studies are still encouraged to investigate other understudied influencing variables to gain fresh and different perspectives on findings.

5.6 Recommendations for Future Research

In order to solve the problem of limited amount of free data available, future studies should try to gain access from limited access website to get higher suitability data of the independent variable. Besides that, the data could also be gained from some academic research reports, but they should be compared with each other to increase the accuracy level of the data. For instance, researchers need to be careful of the positive and negative signs of data as some researchers might make careless mistake when retrieving the data. Therefore, the comparison of the academic research reports is needed, otherwise the data should be obtained from higher quality or priced academic research reports from limited access websites.

In addition, there are other potential factors such as political stability that will also affect the Malaysian Ringgit exchange rate. The strength of a nation's currency can vary depending on its political climate and economic health. Investment flows away from those nations that are thought to have more political and economic risk toward those with lower risk of political turmoil. The value of a nation's currency rises when foreign investment increases, while depreciation is more likely to occur in nations where political unrest is a problem. Thus, scholars could include other factors into their model to further extend the studies.

5.7 Conclusion

This study investigates whether Malaysian Ringgit exchange rate will be influenced by interest rate, inflation, hot money and stock market return. In both short-run and long-run, there is a significant relationship between Malaysian Ringgit exchange rate and the independent variables of hot money and stock market return. However, interest rate and inflation have insignificant relationship with Malaysian Ringgit exchange rate. All in all, this study provides crucial and updated insights for policy makers, investors, traders and scholars, which these parties could utilise this piece of research for strategising and for further research.

REFERENCES

Abdullahi Musa, Salisu, A. A., Aliyu, V. O., & Mevweroso, C. R. (2021). Analysis of asymmetric response of exchange rate to interest rate differentials: The case of African Big 4. *North American Journal of Economics and Finance.* https://www-sciencedirect-com.libezp2.utar.edu.my/science/article/pii/S1062940820302072

Abdulnasser Hatemi-J & Eduarda Roca. (2005). Exchange rates and stock prices interaction during good and bad times: evidence from the ASEAN4 countries. Applied Financial Economics. 15(8). http://dx.doi.org/10.1080/09603100500056635

Adam Aziz. (2023, January 9). Cost of living issues to persist even as growth moderates. *The Edge Markets*. Retrieved February 20, 2023, from https://www.theedgemarkets.com/node/649873

Adam Aziz. (2020, March 13). Ringgit weakens near 4.30 against US dollar as Covid-19 spurs haven currency demand. *The Edge Markets.* Retrieved February 20, 2023, from https://www.theedgemarkets.com/article/ringgit-weakens-near-430-against-us-dollar-covid19-spurs-haven-currency-demand

Adeniji, S. O. (2013). *Exchange rate volatility and inflation upturn in Nigeria: testing for Vector Error Correction Model*. Economics Department, University of Lagos, Nigeria. https://mpra.ub.uni-muenchen.de/52062/1/MPRA_paper_52062.pdf

Ahmed Saeed, Rehmat Ullah Awan, Maqbool. H. Sial, & Falak Sher. (2012). An econometric analysis of determinants of exchange rate in Pakistan. *International Journal of Business and Social Science.* https://www.researchgate.net/profile/Maqbool-Sial/publication/264540002_AN_ECONOMETRIC_ANALYSIS_OF_DETERMINANTS_OF_EXCHANGE_RATE_IN_PAKISTAN/links/53e34a790cf2b9d0d8332833/AN-ECONOMETRIC-ANALYSIS-OF-DETERMINANTS-OF-EXCHANGE-RATE-IN-PAKISTAN.pdf

Andrea Salas Ortiz & Rodrigo Gomez Monge. (2015). Finding International Fisher Effect to Determine the Exchange Rate Through the Purchasing Power Parity Theory: The Case of Mexico During the Period 1996-2012. *Applied Econometrics and International Development, 15(1), 1-14*. https://www.usc.es/economet/reviews/aeid1518.pdf

Andrew, D. W. K. (1993). Test for parameter instability and structure change with unknown change point. *Econometric*, *61*(4), 821-856. https://doi.org/10.2307/2951764

Anita Mirchandani. (2013). Analysis of macroeconomic determinants of exchange rate volatility in India. *International Journal of Economics and Financial Issues.* https://dergipark.org.tr/en/download/article-file/362750

Asila Jalil. (2022, April 13). Russia-Ukraine conflict will affect E&E sector growth, inflation. *The Malaysian Reserve.* Retrieved February 20, 2023, from https://themalaysianreserve.com/2022/04/13/russia-ukraine-conflict-will-affect-ee-sector-growth-inflation/

Bai, J., & Ng, S. (2005). Tests for Skewness, Kurtosis, and Normality for Time Series Data. *Journal of Business & Economic Statistics*, *25*(1). https://doi.org/10.1198/073500104000000271

Balke, N. S., & Wohar, M. E. (1998). *Nonlinear dynamics and covered interest rate parity. Empirical Economics*, 23(4):535-559. https://doi.org/10.1007/BF01205993

Bank Negara Malaysia. (2005). *Malaysia adopts a managed float for the ringgit exchange rate.* https://www.bnm.gov.my/-/malaysia-adopts-a-managed-float-for-the-ringgit-exchange-rate

Bank Negara Malaysia. (2008). *Statement by governor of Bank Negara Malaysia on the exchange rate regime.* https://www.bnm.gov.my/-/statement-by-governor-of-bank-negara-malaysia-on-the-exchange-rate-regime

Bank Negara Malaysia. (2019). *Information on Local Currency Settlement Framework.* https://www.bnm.gov.my/-/information-on-local-currency-settlement-framework

Bank Negara Malaysia. (2023). *Overnight policy rate decisions.* https://www.bnm.gov.my/monetary-stability/opr-decisions

Boudias, R. (2015). Capital inflows, exchange rate regimes and credit dynamics in emerging market economies. *International Economics*. https://doi.org/10.1016/j.inteco.2015.05.001

CFI Team. (2022). *Asian financial crisis.* Retrieved February 20, 2023, from https://corporatefinanceinstitute.com/resources/knowledge/finance/asian-financial-crisis/

Chen, Z. (2022). *The impact of trade and financial expansion on volatility of real exchange rate*. https://doi.org/10.1371/journal.pone.0262230

Chetty, P. (2018). *Auto regressive distributed lag model (ARDL) and its advantages*. https://www.projectguru.in/auto-regressive-distributed-lag-model-ardl/

Choueiry, G. (2022). *What is an Acceptable Value for VIF?* https://quantifyinghealth.com/vif-threshold/

Combes, J., Kinda, T. & Plane, P. (2012). Capital flows, exchange rate flexibility, and the real exchange rate. *IMF Working Paper, 11*(9). https://www.imf.org/external/pubs/ft/wp/2011/wp1109.pdf

Contractor, F. J. (2019). What do we mean by undervalued or overvalued currencies? *Rutgers Business Review, 4.* https://ssrn.com/abstract=3378638

Corporate Finance Institute. (2019). *International Fisher Effect (IFE) – What is the International Fisher Effect (IFE)*? https://corporatefinanceinstitute.com/resources/knowledge/economics/international-fisher-effect-ife/

Debasish Kumar Das. (2016). Determinants of current account imbalance in the global economy: a dynamic panel analysis. *Journal of Economics Structure, 8*. https://journalofeconomicstructures.springeropen.com/articles/10.1186/s40008-016-0039-6

Dekle, R., Hsiao, C., & Wang, S. (2002). High interest rates and exchange rate stabalization in Korea, Malaysia and Thailand: An empirical investigation of the traditional and revisionist views. *Review of International Economics, 10*(1). https://doi.org/10.1111/1467-9396.00318

Dhamotharan, L., & Mohd Tahir Ismail. (2015a). The behavior of exchange rate and interest rate differential in malaysia: evidence from wavelet analysis. *Australian Journal of Basic and Applied Sciences.* https://www.researchgate.net/publication/274891718_The_Behaviour_of_Exchange_Rate_and_Interest_Rate_Differential_in_Malaysia_Evidence_from_Wavelet_Analysis

Dhamotharan, L., & Mohd Tahir Ismail. (2015b). Exchange rate and interest rate differential in china: a wavelet approach. *Advanced Science Letters.* https://www.researchgate.net/publication/283685776_Exchange_Rate_and_Interest_Rate_Differential_in_China_A_Wavelet_Approach

Duarte, M. & Stockman, A. C. (2005). Rational speculation and exchange rates. *Journal of Monetary Economics. 52*(1). https://doi.org/10.1016/j.jmoneco.2004.08.004

Edwards, S. & Rigobon, R. (2009). Capital controls on inflows, exchange rate volatility and external vulnerability. *Journal of International Economics, 78*(2),256-267. https://doi.org/10.1016/j.jinteco.2009.04.005

Elder, J. (2003). An impulse-response function for a vector autoregression with multivariate GARCH-in-mean. *Economics Letters, 79*(1). https://doi.org/10.1016/S0165-1765(02)00283-5

Fadli Fizari Abu Hassan Asari, Nurul Syuhada Baharuddin, Nurmadihah Jusoh, Zuraida Mohamad, Norazidah Shamsudin, & Kamaruzaman Jusoff. (2011). A

vector error correction model (VECM) approach in explaining the relationship between interest rate and inflation towards exchange rate volatility in Malaysia. *World Applied Sciences Journal 12*. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.390.8762&rep=rep1&type=pdf

Frieden, J. (2008). Globalization and exchange rate policy. *The Book of Future Globalization*. https://wcfia.harvard.edu/publications/globalization-and-exchange-rate-policy

Gamze Şekeroğlu, & Melek Acar. (2020). The effect of hot money on stock exchange index exchange rates and interest rates: the case of Turkey. *CES Working Papers, Centre for European Studies, Alexandru Ioan Cuza University, vol. 12(3), pages 213-227.* https://ideas.repec.org/a/jes/wpaper/y2020v12i3p213-227.html

Ganeshwaran Kana. (2022, July 30). Weaker ringgit raises concerns. *The Star*. Retrieved February 24, 2023, from https://www.thestar.com.my/business/business-news/2022/07/30/weaker-ringgit-raises-concerns

Gang, G. T., & Ma, S. (2010). The relationship between stock returns and the foreign exchange rate: the ARDL approach. *Journal of the Asia Pacific Economy, 15*(4), 490-508. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2494018

Gaurav Agrawal, Aniruddh Kumar Srivastav & Ankita Srivastava. (2010). A Study of Exchange Rates Movement and Stock Market Volatility. *International Journal of Business and Management, 5*(12). https://www.ccsenet.org/journal/index.php/ijbm/article/view/8485

Gidigbi, M. O., Babarinde, G. F., & Lawan, M. W. (2018) Inflation and exchange rate volatility pass-through in Nigeria. *Journal of Management, Economics, and Industrial Organization.* https://www.researchgate.net/profile/Gbenga-Babarinde/publication/327373936_Inflation_and_Exchange_Rate_Volatility_Pass-Through_in_Nigeria/links/5d4a009892851cd046a6b2f2/Inflation-and-Exchange-Rate-Volatility-Pass-Through-in-Nigeria.pdf

Glen, S. (2016). *KPSS Test: Definition and interpretation.* https://www.statisticshowto.com/kpss-test/

Grangera, C. W. J., Huangb, B. N. & Yang, C. W. (2000). A bivariate causality between stock prices and exchange rates: evidence from recent Asianflu. The Quarterly *Review of Economics and Finance, 40*(3), pg337-354. https://doi.org/10.1016/S1062-9769(00)00042-9

Grauwe, P. D. (2000). Exchange rates in search of fundamentals: The case of the Euro-Dollar rate. *International Finance, 3*(3).

https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.18.4643&rep=rep1&type=pdf

Grossmann, A. & Orlov, A. G. (2022). Exchange rate misalignments, capital flows and volatility. The North American Journal of Economics and Finance. 60, 101640. https://doi.org/10.1016/j.najef.2022.101640

Grydaki, M., & Fountas, S. (2010). *What Explains Nominal Exchange Rate Volatility? Evidence from the Latin American Countries*. https://www.researchgate.net/publication/46473272_What_Explains_Nominal_Exchange_Rate_Volatility_Evidence_from_the_Latin_American_Countries

Gujarati, D.N. & Porter, D.C. (2009). *Basic econometrics*. (5th ed.). Boston, MA: McGraw-Hill/Irwin.

Har, W. M., Tan, A. L., Lim, C. H., & Tan, C. T. (2017). Does interest rate still matter in determining exchange rate? *Capital Markets Review, 25*(1). http://www.mfa.com.my/wp-content/uploads/2017/12/vol251_pp.19-25-har-et-al..pdf

Hashchyshyna, A., Marushchak, K., Sukhomlyn, O., & Tarasenko, A. (2020). How does the interest rate influence the exchange rate? *Visnyk of the National Bank of Ukraine*. https://www.researchgate.net/publication/349999662_How_Does_the_Interest_Rate_Influence_the_Exchange_Rate

Hayatun Razak. (2022, July 4). Why does the ringgit weaken when the US increases interest rates? *The Sun Daily*. Retrieved February 22, 2023, from https://www.thesundaily.my/home/why-does-the-ringgit-weaken-when-the-us-increases-interest-rates-YB9407375

Hoffman, M., & MacDonald, R. (2009). Real exchange rates and real interest rate differentials: A present value interpretation. *European Economic Revie*w. https://www-sciencedirect-com.libezp2.utar.edu.my/science/article/pii/S0014292109000531

HSBC Group. (n.d.) *What drives exchange rates*? Retrieved March 1, 2023, from https://www.expat.hsbc.com/international-banking/what-makes-exchange-rates-move/

Ibarra, C.A. (2011). Capital Flows and Real Exchange Rate Appreciation in Mexico. *World Development*, *39*(12), 2080–2090. https://doi.org/10.1016/j.worlddev.2011.05.020

International Banker. (2015). *Accounting for the Malaysian Ringgits slump in 2015.* Retrieved February 20, 2023, from https://internationalbanker.com/brokerage/accounting-for-the-malaysian-ringgits-slump-in-2015/

Iyke, B. N. & Ho, S. (2021). Exchange rate exposure in the South African stock market before and during the COVID-19 pandemic. *Finance Research Letters, 43*. https://doi.org/10.1016/j.frl.2021.102000

Karahan, O. & Colak, O. (2019). The link between financial capital movements and the exchange rate in Turkey. *Eastern Journal of European Studies, 10*(2). Pg 26-281. https://www.researchgate.net/publication/338431689_The_link_between_financial_capital_movements_and_the_exchange_rate_in_Turkey

Kodongo, O., & Ojah, K. (2012). The dynamic relation between foreign exchange rates and international portfolio flows: Evidence from Africa's capital markets. *International Review of Economics & Finance, 24*, 71-87. https://www.sciencedirect.com/science/article/abs/pii/S1059056012000056?via%3Dihub

Kwiatkowski, D., Phillips, P. C. B., Schmidt, P. & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics*, *54*(1-3). https://doi.org/10.1016/0304-4076(92)90104-Y

Lee, Y., Huang Y. & Chen, T. (2017). Does Hot Money Impact Stock And Exchange Rate Markets On China? *Asian Academy of Management Journal of Accounting and Finance (AAMJAF), 13*(2), 95-108. https://ideas.repec.org/a/usm/journl/aamjaf01302_95-108.html

Levine, S. (2023). *Inflation no longer has monetary applications.* Retrieved February 20, 2023, from https://www.investing.com/analysis/inflation-no-longer-has-monetary-applications-200635473

Li, W., Lu, X., Ren, Y., & Zhou, Y. (2018). Dynamic relationship between RMB exchange rate index and stock market liquidity: A new perspective based on MF-DCCA. *International Review of Economics & Finance, 24* ,71-87. https://www.researchgate.net/publication/325535489_Dynamic_relationship_between_RMB_exchange_rate_index_and_stock_market_liquidity_A_new_perspective_based_on_MF-DCCA

Li, X., Su, C.-W., Chang, H.-S. & Ma, J. (2018). Do short-term international capital movements play a role in exchange rate and stock price transmission mechanism in China. *International Review of Economics & Finance, 57*. https://doi.org/10.1016/j.iref.2018.02.010

Lim, M. H., & Goh, S. K. (2012). How Malaysia weathered the financial crisis: Policies and possible lessons. *The North-South Institute L'Institut Nord-Sud.* http://www.nsi-ins.ca/wp-content/uploads/2012/09/2012-How-to-prevent-the-next-crisis-Malaysia.pdf

Lim, S. Y. & Sek, S. K. (2014). Exploring the inter-relationship between the volatilities of exchange rate and stock return. *Procedia Economics and Finance, 14.* https://doi.org/10.1016/S2212-5671(14)00725-4

Lin, C.-H. (2012). The co movement between exchange rates and stock prices in the Asian emerging markets. *International Review of Economics & Finance*. 22(1),161-172. https://doi.org/10.1016/j.iref.2011.09.006

Liu, L. & Wan, J. (2012). The relationships between Shanghai stock market and CNY/USD exchange rate: New evidence based on cross-correlation analysis, structural cointegration and nonlinear causality test. *Physica A: Statistical Mechanics and its Applications, 391*(23). https://doi.org/10.1016/j.physa.2012.07.036

Long, S., Zhang, R. & Hao, J. (2022). Asymmetric impact of Sino-US interest rate differentials and economic policy uncertainty ratio on RMB exchange rate. *Journal of International Financial Markets, Institutions & Money.* https://www-sciencedirect-com.libezp2.utar.edu.my/science/article/pii/S1042443122000555

Lu, C., & Zhou, X. (2010). Impulse-Response function Analysis: An application to macroeconomic data of China. *D-level Essay in Statistics.* http://www.statistics.du.se/essays/D10_Xinzhou_lucao.pdf

Lu, D., Liu, J. & Zhou, H. (2022). Global financial conditions, capital flows and the exchange rate regime in emerging market economies. *Journal of International Financial Markets, Institutions and Money, 77*. https://doi.org/10.1016/j.intfin.2021.101500

Lütkepohl, H. & Kratzig, M. (2004). *Applied Time Series Econometrics*. https://s2pnd-matematika.fkip.unpatti.ac.id/wp-content/uploads/2019/03/Themes-in-Modern-Econometrics-Helmut-L%C3%83%C2%BCtkepohl-Markus-Kr%C3%83%C2%A4tzig-Applied-time-series-econometrics-CUP-2004.pdf

Lütkepohl, H. (2010). Variance Decomposition. *Macroeconometrics and Time Series Analysis*. https://doi.org/10.1057/9780230280830_38

Masih, A.M.M., Albinali, K. & DeMello, L. (2010). Price dynamics of natural gas and the regional methanol markets. *Energy Policy, 38*(3). https://doi.org/10.1016/j.enpol.2009.11.018

Mayowa G, A., & Olushola E., I. (2013). The determinants of real exchange rate volatility in Nigeria. *Academic Journal of Interdisciplinary Studies, 2(1), 459*. https://www.richtmann.org/journal/index.php/ajis/article/view/99

Menegaki, A. N. (2019). The ARDL Method in the Energy-Growth Nexus Field; Best Implementation Strategies. *Economies, 7*(4). https://doi.org/10.3390/economies7040105

Mohammad Chowdhury, & Md. Tnajil Hossain. (2015). Determinants of exchange rate in Bangladesh: A case study. *Journal of Economics and Sustainable Development.* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2668804

Naushan, H. (2021). *Multivariate Autoregressive Models and Impulse Response Analysis.* https://towardsdatascience.com/multivariate-autoregressive-models-and-impulse-response-analysis-cb5ead9b2b68

Ng, M. C. & Caroline Geetha (2020). The impact of monetary variables on exchange rate in Malaysia from 2013 to 2015. *Malaysian Journal of Business and Economics, 7.* https://jurcon.ums.edu.my/ojums/index.php/mjbe/article/view/2893/1930

Ning, Y. & Zhang, L. (2018). Modeling dynamics of short-term international capital flows in China: A Markov regime switching approach. *The North American Journal of Economics and Finance, 44,* 193-203. https://doi.org/10.1016/j.najef.2018.01.002

Nkoro, E. & Uko, A.K. (2016). Autoregressive Distributed Lag (ARDL) cointegration technique: application and interpretation. *Journal of Statistical and Econometric Methods, 5*(4), 63-91. https://www.scienpress.com/Upload/JSEM/Vol%205_4_3.pdf

Noer Azam Achsani, Fauzi, A. J. F. A., Abdullah, P. (2010). The relationship between inflation and real exchange rate: comparative study between ASEAN+3, the EU and North America. *European Journal of Economics, Finance and Administrative Sciences.* https://www.researchgate.net/publication/290086746_The_relationship_between_inflation_and_real_exchange_rate_Comparative_study_between_ASEAN3_the_EU_and_North_America

Norzila Abdul Aziz. (2013). Foreign exchange intervention in Malaysia. *Bank for International Settlements, 73.* https://EconPapers.repec.org/RePEc:bis:bisbpc:73-16

Nitrabampa, D., & Iraya, C. (2019). The effect of interest rate differentials on exchange rate volatility of East African community currencies. *European Scientific Journal, ESJ*, *15*(19), 203. https://doi.org/10.19044/esj.2019.v15n19p203

O'Neill, A. (2022). Malaysia: Unemployment rate from 1999 to 2020. *Statista.* https://www.statista.com/statistics/319019/unemployment-rate-in-malaysia/

Oner, C. (2019, July 23). Inflation: prices on the rise. *International Monetary Fund.* Retrieved February 4, 2023, from https://www.imf.org/external/pubs/ft/fandd/basics/30-inflation.htm

Özcan Karahan & Olcay Çolak. (2019). The link between financial capital movements and the exchange rate in Turkey. *Journal of European Studies, 10*(2).

https://www.researchgate.net/publication/338431689_The_link_between_financial_capital_movements_and_the_exchange_rate_in_Turkey

P Prem Kumar. (2022, July 6). Malaysia raises key rate again to 2.25% amid COVID recovery. *Nikkei Asia.* Retrieved February 4, 2023, from https://asia.nikkei.com/Business/Markets/Currencies/Malaysia-raises-key-rate-again-to-2.25-amid-COVID-recovery

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics 16(3)*, 289–326. http://www.jstor.org/stable/2678547

Peter C. B. Phillips., & Pierre Perron. (1988). Testing for a unit root in time series regression. *Biometrika, 75(2).* https://doi.org/10.1093/biomet/75.2.335

Ploberger, W., & Kramer, W. (1992). The CUSUM test with OLS residuals. *Econometrica, 60(2),* 271-285. https://doi.org/10.2307/2951597

Pradyumna Dash. (2012) *The relationship between interest rate and exchange rate in India.* http://oii.igidr.ac.in:8080/jspui/bitstream/2275/214/1/dash_1_.pdf

Puci, J., & Manasaku, S. (2016). An Empirical Evidence of the International Fisher Effect on the USD to CNY Exchange Rate. *Academic Journal of Interdisciplinary Studies, 5(1),* 1-8. https://www.researchgate.net/publication/351687490_An_Empirical_Evidence_of_the_International_Fisher_Effect_on_the_USD_to_CNY_Exchange_Rate

Ramsey, J. B. (1969). Tests for specification errors in classical linear least-squares regression analysis. *Journal of the Royal Statistical Society*. *Series B (Methodological),31(2)* 350-371. http://www.jstor.org/stable/2984219

Ravindran Ramasamy, & Soroush Karimi Abar (2015). Influence of macroeconomic variables and exchange rates. *Journal of Economics, Business and Management, 3*(2), 276-281. http://www.joebm.com/index.php?m=content&c=index&a=show&catid=40&id=478

Rockeman, O. (2022). US Inflation quickens to 9.1%, amping up Fed pressure to go big. *Bloomberg.* Retrieved February 4, 2023, from https://www.bloomberg.com/news/articles/2022-07-13/us-inflation-accelerates-to-9-1-once-again-exceeding-forecasts

Roya, S. & Kemme, D.M. (2020). The run-up to the global financial crisis: A longer historical view of financial liberalization, capital inflows, and asset bubbles. *International Review of Financial Analysis*. 69, 101377. https://doi.org/10.1016/j.irfa.2019.101377

Samuel Antwi, Mohammed Issah, Aboagyewaa Patience & Solomon Antwi. (2020). The effect of macroeconomic variables on exchange rate: Evidence from Ghana. *Cogent Economics & Finance, 8*. https://www.tandfonline.com/doi/full/10.1080/23322039.2020.1821483

Seyfettin Erdoğan, Ayfer Gedikli, & Emrah İsmail Çevik. (2020). Volatility spillover effects between Islamic stock markets and exchange rates: Evidence from three emerging countries. *Borsa Istanbul Review, 20*(4), 322-333. https://doi.org/10.1016/j.bir.2020.04.003

Shaffer, L. (2015, September 24). Does Malaysia's ringgit face 1997 all over again? *CNBC*. Retrieved February 4, 2023, from https://www.cnbc.com/2015/09/24/malaysian-ringgit-sell-off-may-worsen-over-economy-1mdb-najib.html

Tafa. J (2015). Relationship between Exchange Rates and Interest Rates: Case of Albania. *Mediterranean Journal of Social Sciences, 6*(4), 163. https://www.richtmann.org/journal/index.php/mjss/article/view/6914

Taoufik Bouraoui & Archavin Phisuthtiwatcharavong. (2015). On the Determinants of the THB/USD Exchange Rate. *Procedia Economics and Finance, 30*. https://doi.org/10.1016/S2212-5671(15)01277-0

Tari, R. & Gozen, M. C (2018). *Portfolio Balance Approach to Exchange Rate Determination: Testing a Model by Applying Bilateral Data of Turkey and United States.* Retrieved from: https://dergipark.org.tr/en/download/article-file/602067

Tariq Mahmood Ali, Muhammad Tariq Mahmood, & Tariq Bashir. (2015). Impact of interest rate, inflation and money supply on exchange rate volatility in Pakistan. *World Applied Sciences Journal 33* (4): 620-630, 2015. https://www.pcst.org.pk/docs/2015-Impact_of_Interest_Rate_Inflation_and_Money_Supply_on_Exchange_Rate_Volatility_in_Pakistan.pdf

Tan, A. L. (2022, July 22). Malaysia inflation rate rises to 3.4% in June, driven by surging food prices. *Business Times.* Retrieved February 4, 2023, from https://www.businesstimes.com.sg/asean-business/malaysia-inflation-rate-rises-to-34-in-june-driven-by-surging-food-prices

Taylor, A. M., & Taylor, M. P. (2004). The purchasing power parity debate. *The Journal of Economic Perspectives, 18(4)*:135-158. http://www.jstor.org/stable/3216796

Taylor, J. T. (2001). The Role of the Exchange Rate in Monetary Policy Rules. *The American Economic Review, 91(2),* 263- 267. http://www.jstor.org/stable/2677771

Taylor, M. P. (1987). Covered interest parity: a high-frequency, high-quality data study. *Economica*: *54(216),* 429-438. https://doi.org/10.2307/2554178

Tepper, T. (2022, August 3). Federal funds rate history 1990 to 2022. *Forbes Advisor.* Retrieved February 4, 2023, from https://www.forbes.com/advisor/investing/fed-funds-rate-history/

The Borneo Post. (2015, April 11). *Impact of the depreciating ringgit*. Retrieved February 4, 2023, from https://www.theborneopost.com/2015/04/11/impact-of-the-depreciating-ringgit/

Tsai, I.-C. (2012). The relationship between stock price index and exchange rate in Asian markets: A quantile regression approach. Journal of International Financial Markets, Institutions and Money. 22(3), 609-621. https://doi.org/10.1016/j.intfin.2012.04.005

Tule, M., Dogo, M. & Uzonwanne, G. (2018). Volatility of stock market returns and the naira exchange rate. *Global Finance Journal, 35,* 97-105. https://doi.org/10.1016/j.gfj.2017.08.001

Türsoy, T. (2017). Causality between Stock Prices and Exchange Rates in Turkey: Empirical Evidence from the ARDL Bounds Test and a Combined Cointegration Approach. *International Journal of Financial Studies.* https://www.mdpi.com/2227-7072/5/1/8/htmAutoregressive

Walid Chkili & Duc Khuong Nguyen (2014). Exchange rate movements and stock market returns in a regime-switching environment: Evidence for BRICS countries. *Research in International Business and Finance*. https://www.sciencedirect.com/science/article/pii/S0275531913000792

Wan Mohd Yaseer Mohd Abdoh, Noor Hafizha Muhamad Yusuf, Shaliza Azreen Mohd Zulkifli, Norhisam Bulot, & Nor Jamilah Ibrahim. (2016). Macroeconomic factors that influence exchange rate fluctuation in ASEAN countries. *International Academic Research Journal of Social Science, 2*(1). http://www.iarjournal.com/wp-content/uploads/IARJ-SS-20161-89-94.pdf

Wilson, L., & Sheefeni, J, P. (2014). The Relationship between Interest Rate and Exchange Rate in Namibia. *Journal of Emerging Issues in Economics, Finance and Banking (JEIEFB).* https://www.researchgate.net/profile/Johannes-P-S-Sheefeni/publication/308202287_The_Relationship_Between_Interest_Rate_and_Exchange_Rate_in_Namibia/links/57dd840408aeea195938c8b9/The-Relationship-Between-Interest-Rate-and-Exchange-Rate-in-Namibia.pdf

Woon, K. J. (2022, June 20). ECON-templation: The cost of pegged exchange rate regime. *The Edge Markets.* Retrieved February 4, 2023, from https://www.theedgemarkets.com/article/econtemplation-cost-pegged-exchange-rate-regime

Yussuf, C. Y. (2021). Cointegration test for the long-run economic relationships of East Africa community: Evidence from a meta-analysis. *Asian Journal of Economics and Banking*. https://doi.org/10.1108/AJEB-03-2021-0032

Zeng, H., Abdullahi D. Ahmed, Lu, R. & Dai, N. (2022). Dependence and spillover among oil market, China's stock market and exchange rate: new evidence from the Vine-Copula-CoVaR and VAR-BEKK-GARCH frameworks. *Heliyon, 8*(11). https://doi.org/10.1016/j.heliyon.2022.e11737

Zhang, J., & Dou, Y. (2010). The Effectiveness of Interest Rate Parity. *The ANU Undergraduate Research Journal.* www.semanticscholar.org/paper/The-Effectiveness-of-Interest-Rate-Parity-Zhang-Dou/54c558c640

Zhao, H. (2010). Dynamic relationship between exchange rate and stock price: Evidence from China. *Research in International Business and Finance, 24*(2), pg103-112. https://www.sciencedirect.com/science/article/pii/S0275531909000294