IMPACT OF Covid-19 TOWARD MALAYSIA ECONOMY

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DECLARATION

We hereby declare that:

1. This undergraduate research project 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 research project 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 research project.
4. The word count of this research report is about 10,075 words.

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DEDICATION

We would like to dedicate this dissertation to our family and friends who have given us their best support and encouragement during the preparation of this thesis.

Moreover, this thesis is also dedicated to our supervisor, Dr. Tan Chai Thing for her advice and guidance to assist us in completing this thesis.

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List of Abbreviations

AD	Aggregate Demand
ADL	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
AS	Aggregate Supply
BNM	Bank Negara Malaysia
COVID-19	Coronavirus Disease 2019
CPI	Consumer Price Index
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum Square
DOSM	Department of Statistics Malaysia
ECM	Error Correlation Model
GDP	Gross Domestic Product
IMF	International Monetary Fund
JB	Jarque-Bera
MCO	Movement Control Order
OCED	Organization For Economic Co-operation and Development
OLS	Ordinary Least Square
PP	Phillips-Perron
PPP	Purchasing Power Parity
Q1	Quarter 1
SADC	Southern African Development Community
TOL	Tolerance
VECM	Vector Error Correction Model
VIF	Variance Inflation Factor
WHO	World Health Organization
USD	United States Dollar

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PREFACE

This research project is submitted as partly to fulfill the requirement of the course of Bachelor of Economics (Honours) Financial Economics by having Dr. Tan Chai Thing as the project supervisor. The topic chosen was “Impact of Covid-19 towards Malaysia Economy”. This project was written solely by the authors with supporting facts from research by others which are quoted with references.

There are few researches that have done regarding the effect of Covid-19. Covid-19 has been a big issue which cause a big disruption to most economic activities of many countries. This topic was chosen was due to the fact that so little research has been done on the topic especially in Malaysia and significance has yet to be proved. Thus, the goal of these options was to move the specialised research one step closer to a definite outcome.

This research was considered a success and it was all because this research could help and contribute to future studies on this topic. Additional study about economic indicators and GDP growth rate in Malaysia could very much allow researchers to better understand the existence of relationship among each other during the Covid-19 pandemic. Our main goal is to identify the relevant factors that are significant in examining the effect of exchange rate, interest rate and inflation rate on GDP growth rate of Malaysia during Covid-19 pandemic. This study is done in hope that it can be beneficial to various parties.

ABSTRACT

In this research study, we have gone through our investigation on the impact of Covid-19 towards Malaysia economy. The effects of Covid-19 have been disastrous for the world economy. It has been the latest global risk to disrupt Malaysia's GDP growth rate. According to DOSM, since Malaysia went through the pandemic, the country's GDP index has dropped significantly from 2019 to 2020, from 4.3% to -5.6%. Some economic indicators such as exchange rate, inflation rate, and interest rate were also impacted severely during the Covid-19 pandemic. Thus, we would like to examine the relationship between exchange rate, inflation rate, interest rate with GDP growth rate of Malaysia during Covid-19 pandemic. We have applied ARDL model together with unit root test, CUSUM test, heteroskedasticity test, autocorrelation test, multicollinearity test and normality test by having sample period from January 2020 to March 2022 which included 27 observations. Throughout the findings, we discovered that there exists negative relationship among the exchange rate, inflation rate, interest rate with GDP growth rate of Malaysia in the long run. By having this finding, we hope that it may assist future researchers with some information about the impact of covid-19 on Malaysia's economy. Additionally, policymakers and investors could have a study report for references in order to help them to make decision making to prevent uncertainty. Although this study has faced the limitation of lacking a data sample period, other researchers may be able to observe more sample periods which will be more accurate in the future as time goes by. We encourage future researchers to have comparisons of past, present and post Covid-19 pandemics and cover more variables in order to detect the impacts more obviously as references for policy implications in future.

Keywords: ARDL Model, Covid-19, Malaysia, secondary data, exchange rate, interest rate, inflation rate

CHAPTER 1 INTRODUCTION

1.1 Background of Study

Covid-19 has been an infectious disease caused by serious respiratory acute coronavirus syndrome. Every country has adopted strict measures in response to the outbreak. Most experts expect that the virus is mainly from person to person via a few ways like airborne transmission, faecal-oral transmission, droplets or aerosols, and surface transmission. The world is following lockdown procedures as precautionary measures, such as mandatory national lockdowns and border closures, in the hope of limiting the speed of the virus' spread while minimising the pandemic. In fact, Malaysia has taken some actions in dealing with the Covid-19 pandemic. The Prime Minister of Malaysia has implemented Movement Control Order (MCO) in March 2020 to avoid the widespread spread of the virus. The MCO played an important role in the early stage of its implementation, effectively controlling the increase in the number of pandemics (Mustaffa, 2021).

The first case of coronavirus was detected at the year-end of 2019 in Wuhan City of China. It was then spread rapidly around the world in the first quarter of 2020 and caused it to become a global issue of the world. According to the latest news, only vaccines have been invented to boost the body's immune system against Covid-19, but no official cure or cure for the disease has been invented, causing great panic among citizens of the world. It has taken many lives and is taking lives. Cases of the disease are spreading exponentially around the world. On January 25, 2020, the first confirmed case in Malaysia entered through neighbouring Singapore, and all three infected persons were citizens of China (Elengoe, 2020). As of April 8, 2022, the cumulative number of new coronavirus cases in Malaysia has reached 4,307,529, including local and imported cases. The number of deaths due to the epidemic is 35,259, and the total number of recoveries is 4,113,831. On March 5 this year, the number of infections in a single day hit a record 33,406.

The effects of Covid-19 have been disastrous for the world economy. Both the private and public sectors screwed up because of this virus. Inevitably, the impact of the novel coronavirus will have major national, economic and social implications. The growing threat of the novel coronavirus is a public health crisis and has hampered the macroeconomy. Not only that, but it also cuts off the supply chain of the business, causing production and manufacturers to be hindered even more. The World Economic Outlook, revised by the International Monetary Fund (IMF) in June 2020, expects the global economy to contract sharply by 4.9% in 2020,

much lower than the 2008-09 financial crisis. The Organization for Economic Co-operation and Development (OECD) has stated that the spreading of Covid-19 has caused global socioeconomic distress and global economic instability.

Table 1.1: Percentage change of GDP (%) from corresponding quarter of the preceding year

Percentage change of GDP (%) from corresponding quarter of the preceding year										
	2019	**2020**	2019	2019	2019	2019	2020	2020	2020	2020
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
GDP	**4.3**	**-5.6**	4.5	4.9	4.4	3.6	0.7	-17.1	-2.6	-3.4

Percentage change of GDP (%) from corresponding quarter of the preceding year							
	2021	2021	2021	2021	2021	2022	2022
		Q1	Q2	Q3	Q4	Q1	Q2
GDP	3.1	-0.5	16.1	-4.5	3.6	5.0	8.9

Sources: Department of Statistics Malaysia (DOSM)

The 2019 coronavirus (Covid-19) pandemic is the latest global risk to disrupt Malaysia's GDP growth rate. According to DOSM, since Malaysia went through the pandemic, the country's GDP index has dropped significantly from 2019 to 2020, from 4.3% to -5.6%. The sharp drop shows that Malaysia has suffered a severe economic blow during the pandemic. Table 1 shows the quarterly GDP growth rates for 2019 (before the pandemic outbreak) and 2020 (after the pandemic outbreak). From the year-end of 2019 to the first 3 months of 2020, the GDP growth rate declined markedly until it fell to a record low of -17.1% in the second quarter of 2020. This event prompted us to examine the effect of Covid-19 on Malaysia's economic performance. In this study, we will focus on examining how it affects Malaysia's GDP growth rate during the Covid-19 pandemic through economic indicators, which include inflation rate, interest rate and exchange rate.

Interest rate reflects a person's or group's rate of time preference since, in economic terms, saving is the decision to forego some present spending in favour of higher future consumption. The interest rate is crucial because a higher interest rate would encourage individuals to deposit more money in banks, which would lead to significant investments and faster GDP development. When examining the relationship between interest rates and the growth of the

economy, there is no doubt that a rising in interest rates would generate investment and boost economic growth. Since the outbreak of Covid-19 in Malaysia, the interest rate has fallen sharply from 0.97% in 2019 to 0.48% in 2020 as of December, according to data from the DOSM. The interest rate then gradually increased to 0.56% in 2021. This year it has also risen to 0.63% as Malaysia‘s economy is in a recovery phase.

Inflation is the long-term reduction in the relative buying power of a currency. Quantitative estimation of the level at which the loss of purchasing power occurs may be obtained from the rise in the average market price of a selected range of products and services over time in a given economy. The increase in pricing, commonly expressed as a percentage, effectively means that a money unit now costs less than it did previously. The demand-pull inflation happened during the Covid-19 pandemic as the demand was heavily exceeding the supply of housing goods and infectious disease prevention goods. This also raised the inflation rate from –1.14% in 2020 to 2.48% in 2021 and predicted it will continue to increase in 2022 and influence the GDP.

The price of a nation's currencies is referred to as the exchange rate. Thus, there are two parts to the exchange rate: home currency and foreign currency, which could be expressed either directly or indirectly. The foreign currency rate greatly impacts a country's level of business operations. For instance, the currency rate for Malaysia in January 2020 was RM4.08 to 1 USD, but by July 2020 it had significantly dropped to RM4.20 to 1 USD. When exchange rates are weaker will lead to cost-push inflation since the cost of imported raw commodities is increasing. Practically each industry would be affected by this situation, however, due to the fact that much of the machinery and equipment in Malaysia's manufacturing industry was imported from China and Japan, this sector would be disproportionately impacted. Because more Malaysian Ringgit must be exchanged for US Dollars, a decline in the value of Malaysia's currency will result in a drop in the Malaysian Ringgit's buying power. This suggests that when Malaysians' purchasing power drops, it leads to dropping living standards too.

The swap in the interest rate, inflation rate and exchange rate during the tough pandemic have shown the impact of the Covid-19 pandemic on the economy in Malaysia. In this study, we will examine how those factors affected Malaysia’s GDP growth rate during the Covid-19 pandemic.

1.2 Problem Statement

The issue began when positive cases in Malaysia were raised from the first case on 25 January 2020 to 117 cases on 17 March 2020. The Government had put in place sector-specific Standard Operating Procedures such as strict stay-at-home bans implemented during the Movement Control Order (MCO) period to stop the virus's spread. All gatherings within Malaysia were forbidden, and educational institutions were compelled to close, including kindergartens, primary and secondary schools, colleges, and universities. All government and private buildings were closed as well, and citizens are required to wear face masks when they are going out. Travel limits were imposed nationally unless the citizens needed to buy or supply vital goods and services.

Gross domestic product (GDP) growth has a direct impact on businesses. In an economic expansion with a growing GDP, the firms or businesses can be grown aggressively. However, in a period with negative growth of GDP in a shrinking economy, businesses must cut off some spending sharply and refocus on revenue streams, markets, and strategies. Many factors affect a country's GDP. Due to the rapid increase in Covid-19 cases in Malaysia in 2020, many sectors of the country have been severely affected. People are forced to work from home due to the highly contagious nature of Covid-19. As a result, many factories and companies are unable to produce products for customers and this indirectly affects GDP. Based on the data uploaded by DOSM, Malaysia dropped in GDP growth rate in 2020 as compared with the previous year 2019.

Inflation has been impacted by the legal implementation of health-related regulatory measures. Mixed data suggests that certain companies, like hotels and entertainment venues, were able to absorb cost increases to boost demand in the face of consumer caution, while others, like hair salons, had more inelastic demand and could pass costs on to customers. Additionally, the spending patterns of families saw a significant shift during the MCO period. The poll revealed a change toward higher food product consumption, likely as a result of households' initial MCO period stockpiling and increased domestic food consumption in general. Along with limits on travel and the forced closure of some industries, there was a decline in spending for categories including transportation, dining out and lodging, as well as recreation and apparel. Even though Malaysia has been in recovery since late 2021, the inflation rate has not gotten any lower so far but on the contrary.

Theoretically, when borrowing money becomes more expensive, growth in interest rates in an economy will deter consumers and businesses from doing so. While simultaneously pushing customers and businesses to save more money because it will earn them a higher return. This should imply a decline in total economic activity, which will result in a fall in consumer spending on goods and services as well as business investment initiatives. This will result in fewer people consuming things, fewer people earning money, fewer goods being produced, and less economic growth overall (GDP will decrease). During the period of Covid-19, the interest rate will fall sharply in Malaysia's economy in 2020. A lower interest rate, theoretically, will make it less expensive to borrow money from banks and offer lower returns on savings, which encourages greater spending and investment and boosts economic activity. Yet the GDP of Malaysia also decreased in the year which led to the awareness of the connection between the interest rate in Malaysia and the GDP growth rate.

In addition, to have an adequate fundamental physical capital stock sustained long-term growth in the economy necessitates strong commerce and foreign exchange market to enable a controlled exchange rate system and attractive trading terms. The Central Bank's goal is to affect the value of the exchange rate of its own nation's currency in a way that will advance the interests of its population, not to make a profit per se. Most parties like investors and traders need to be able to execute business or investment operations easily. However, misalignment of the currency rate frequently hinders economic expansion. Exchange rate discrepancy in developing nations frequently manifests as overvaluation, which harms tradeable products by decreasing manufacturers' actual pricing. During the MCO period, citizens and foreigners are not allowed to enter and exit Malaysia. This will directly affect the exchange rate in the tourist sector as there is inactive demand and supply in the tourist market. In developing and developed countries, the higher exchange rate is expected to have a higher GDP value. However, during this Covid-19 pandemic, there are so many changes happening in the Malaysian economy, which makes us interested to study the link between the exchange rate and GDP during the Covid-19 period.

Currently, the Covid-19 outbreak in Malaysia has reached a Pandemic period. However, most people did not realise the effects of Covid-19 on economic growth in Malaysia. Thus, this research will focus on studying how the inflation rate, interest rate, and exchange rate affect GDP during the Covid-19 pandemic and their relationship.

1.3 Research Questions

- How did the exchange rate affect the GDP growth rate of Malaysia during the Covid-19 pandemic?
- How did interest rates affect the GDP growth rate of Malaysia during the Covid-19 pandemic?
- How did the inflation rate affect the GDP growth rate of Malaysia during the Covid-19 pandemic?

1.4 Research Objectives

The research objectives will be distributed into general and specific objectives.

1.4.1 General Objectives

The general objective of this study is to examine the economic indicators that affect the economic performance in Malaysia during the Covid-19 pandemic.

1.4.2 Specific Objective

The objectives of this study are:

- To examine the relationship between exchange rate and GDP growth rate during the Covid-19 pandemic.
- To examine the relationship between interest rate and GDP growth rate during the Covid-19 pandemic.
- To examine the relationship between the inflation rate and GDP growth rate during the Covid-19 pandemic.

1.5 Significance of the Study

The study will be able to assist the policymakers to have a clear mind and understanding while implementing the appropriate policies or decision-making in the improvement of the country's economic growth during the coronavirus pandemic. Covid-19 has caused various kinds of inconveniences to the country, especially in economic growth. If our country faced an issue

similar to the situation of the Covid-19 pandemic in future, it may be more rational to have quick actions and know the steps continuously by going through this study since this research will go through the relationship between the variables such as exchange rate, interest rate, inflation rate during Covid-19 pandemic. It may help the government of Malaysia to cope with the unpredictable risk by discovering some initiative ways to minimize the risk in future by looking at this study on the significant impact of the independent variables on the GDP growth rate.

Besides, this study is important for investors to have a clear understanding of the relationship between the Malaysian economy with the exchange rate, interest rate, and inflation rate. The investors will know which of the independent variables is significant to the Malaysian economy and how significant the impact of variables will assist them in predicting stock prices' movements properly. Thus, the investors can respond to those impacts to ensure their investment return will not suffer too many losses and can minimize the risks by having good management of their portfolio properly.

1.6 Conclusion

In conclusion, Covid-19 has brought a massive effect on the country's growth all over the world. As in Malaysia, GDP severely went down as some economic indicators have been severely affected such as the exchange rate, inflation rate and interest rate. Thus, this study will examine the relationship between the exchange rate, inflation rate, interest rate and GDP growth rate of Malaysia during the Covid-19 pandemic. Thus, this research also aims to assist policymakers and investors in having better decision making which will be able to minimize the loss if there are similar issues in future.

CHAPTER 2: LITERATURE REVIEW

2.1 Relevant Theory of Study

2.1.1 Purchasing Power Parity (PPP)

The Swedish professor Gustav Cassel developed the purchasing power parity hypothesis. This idea states that the relative purchasing power of two countries' respective currencies determines the exchange rate between them. In order for a unit of currency from one nation to have the same purchasing power in another, the purchasing power parity (PPP) hypothesis states that the nominal exchange rate between two currencies should match the ratio of the aggregate price levels between the two countries. A country's economic performance can be measured by identifying the standard of living of its citizens. David Ricardo believes that it is more accurate to use PPP to compare the standard of living between the two countries. However, to do a comparison of the standard of living for the different countries by using the current exchange rate might affect the accuracy of the result.

From an economic perspective, purchasing power parity is an equivalency coefficient between currencies derived according to differing price levels of countries. This notional exchange rate may vary significantly in order to allow for a fair comparison of the gross domestic product of countries. According to this theory, people are willing to purchase foreign currency since it can be used to buy products and services within the nation. The national currency, on the other hand, has purchasing power for the commodities and services provided by the nation. Therefore, the exchange rate between the two countries depends on the ratio of the purchasing power of the two currencies in the two countries.

2.1.2 Keynesian Economic Theory

Keynesian theory was proposed by John Maynard Keynes during the 1930s. The Keynesian belief is that intervention of the government will cause the economy to stabilize. The aggregate demand (AD) and aggregate supply (AS) curves are the foundation of Keynesian models. Since the short-run AS curves in this model slope upward, movements in the demand side of the economy have an impact on both price and output.

Mamo (2012) asserts that AD and AS produce an adjustment route. The relationship between inflation and economic growth first appears to be positive, but as the adjustment route continues,

it finally shifts to negative. Due to temporal irregularities, there was a positive link between inflation and economic growth at first. Prices don't have the strongest short-term impact on real output; instead, fluctuations in aggregate demand, whether predictable or unanticipated do. The majority of producers think that just their product has increased in price while business as usual is being conducted by other producers. The overall cost has actually increased. As a result, producers keep producing more and more. Additionally, Keynesian economic activity models incorporate the multiplier effect, which multiplies changes in the output by a certain amount. Most producers assume that only their product has increased in price while all other manufacturers are maintaining the same price level. In actuality, the cost has gone up overall. As a result, producers keep increasing their output. The multiplier effect, which states that a change in production is a multiple of an increase or decrease in spending that generates the change, is another feature of Keynesian models of economic activity. A $1 increase in government spending will lead to a more than $1 rise in output if the fiscal multiplier is larger than 1.

2.1.3 Monetary Policy Theory

To ensure that the supply or amount of money available at any given time is under control, the government typically uses monetary policy as one of its main tools for intervention in the overall economy. There are various techniques or tools for achieving this, but the main one that is favoured is adjusting the interest rates, exchange rates, inflation rates, and foreign reserves. (The Investopedia team, 2022). The demand for and supply of money is managed by the federal government through central bank processes via monetary policy. The possibility for industry and company players to borrow money will improve, for instance, when the interest rate is reduced since borrowing will likewise be less expensive. (Tahajuddin, Sulaiman, 2021).

2.2 Empirical Review

There is limited empirical research that examines the connection between the level of the exchange rate, interest rate, inflation rate and economic growth. The empirical review will be divided into 3 parts; Exchange Rate and GDP Growth Rate, Interest Rate and GDP Growth Rate, and Inflation Rate and GDP Growth Rate.

2.2.1 Exchange Rate and GDP Growth Rate

An argument has existed in a discussion of a positive or negative relationship between exchange rate and GDP growth. In general, the conventional view holds that a rising exchange rate has a positive effect on economic growth, while a structuralist perspective holds that a rise in the exchange rate leads to economic contraction (Karahan,2020). According to Ayodele (2014) and Adeniran et al. (2014), both research was conducted in Nigeria by using the same method which is OLS by looking at the link between the exchange rate and GDP growth rate. However, the results from both researches are opposite. Ayodele (2014) discovered that there is a negative relationship and Adeniran et al. (2014) is a positive relationship significantly between exchange rate and GDP growth.

The findings from Ahma et al. (2013) stated that the depreciation of a country's currency will lead to cheaper prices in export and hence the increase in demand for exports will result in an upward trend of GDP growth. By having research in various countries, the same results agreed that the depreciation of the exchange rate will boost the countries to explore more output (Lubis et al., 2017: Madmarov, 2018; Glüzmann et al., 2012). However, Attah-Obeng & Inu (2013) have different results and strongly conclude that the rising exchange rate will result in the positive growth of GDP in the short run by having studied in Ghana. Based on Jakob (2015), he has assumed that a stable condition of a strong country currency will bring more confidence to investors to have their business operation in the country and hence the economic output can be increased.

Based on research carried out by Al-Bayati et al. (2022) which used the ARDL estimation of results indicated that an upward trend of the official exchange rate will result in a declining trend of GDP in the case of Iraq. Since Al-Bayati et al. (2022) covered the sample period from 1988 to 2020, it has reflected the economic situation of Iraq before the Covid-19 pandemic until the outbreak of the Covid-19 period. The findings disclose that, during the Covid-19 pandemic period, it has caused disruptions in economic activities, thus the government of Iraq has taken action to devalue the country's currency.

Throughout the Johansen test, Yusoff & Febrina (2014) stated that there is a short-run and long-run relationship between exchange rate and GDP growth in the case of Indonesia throughout the Johansen cointegration test. Karahan (2020) has discovered that, in Turkey, there is a long-run relationship between the exchange rate and GDP growth rate. The exchange rate affects the GDP growth rate negatively in Turkey. Besides that, Madmarov (2018) and

Hussain et al. (2019) have discovered that the devaluation of a country's exchange rate will have a short-run and long-run positive impact significantly towards GDP growth in their research of Kyrgyz and Pakistan respectively.

2.2.2 Interest Rate and GDP Growth Rate

There is limited research that has been conducted to determine the interest rate and GDP growth rate. According to Matarr & Momodou (2021) research, the link between the GDP growth and the interest rate in the short-run and long-run is examined by, Vector Error Correction Model (VECM) in the Gambia. The result shows that the key inference can be made while interest rates do not directly correlate with economic development in the short run, yet they do negatively affect the performance of the Gambia economy over the long run.

According to Davcev et al. (2018), the research is conducted within Bulgaria, Romania, and Fyrom to examine the relationship between interest rates and GDP growth rate by the Johansen Test. The result indicates that in Bulgaria, the relationship between interest rates and GDP is inverse. Romania's interest rates are negatively correlated with GDP, but at far higher levels than in Bulgaria. Contrarily, Fyrom has a negative relationship between interest rates and GDP.

The Southern African Customs Union (SACU) was the subject of an empirical research study by Taderera et al. (2021), which concluded that policymakers should permit a high sustainable inflation rate for promoting economic growth and the interest rate can be used as a tool for monetary policy to achieve the considered inflation rate that will have a positive impact on economic growth. Based on research conducted by Harswari et al. (2017) between the years 2006 and 2015, the interest rate has a negative substantial influence on GDP.

Moyo & Pierre (2018) investigated the fluctuation in interest rate effect on the SADC nation's performance by using ARDL bound tests. The findings demonstrated that interest rate liberalisation has positive results on the performance of the economies of SADC nations. Economic growth slows down as a result of lower interest rates used to stimulate it. Additionally, using partial least squares (PLS) to test the hypothesis, Semuel & Nurina (2014) research examined the impact of interest rates on Indonesia's GDP. Following the generation of the results, the researchers discovered that the relationship between interest rates and GDP is significantly negative.

2.2.3 Inflation Rate and GDP Growth Rate

Referring to Hoang & Tien (2022), it's a case in Vietnam state that results of OLS estimation show that there is an inverse relationship between inflation and GDP growth by having a sample period of around 40 years. An inflation rate larger than 6% will negatively impact economic growth. On the other hand, an inflation rate smaller than 6% will boost the economy. By looking at the research of Nurul et al. (2017) in Malaysia using the same method to carry out the test and get the results there is an insignificantly negative correlation between inflation and GDP growth. Besides that,

Based on a research study by Nurul et al. (2017) in Malaysia, the finding from the OLS method stated that there is a negative correlation between inflation and GDP growth but insignificantly. Besides that, Islam and Sahajalal (2019) also discovered that Bangladesh's GDP growth is negatively impacted by the country's high inflation rate. However, the findings from Adu-Gyamfi et al. (2020) that using the same model have a different result in the case study of 9 West Africa Countries. It indicated that there is an insignificant effect of inflation on GDP via the fixed effect model but has a negative effect significantly on GDP using the OLS method.

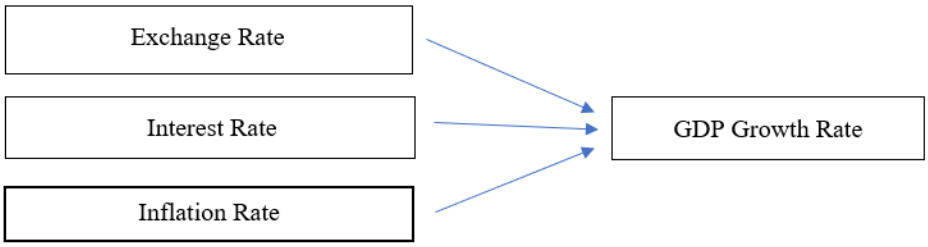
According to the research study of Rouksar-Dussoyea et al. (2017) and Najafi Bousari et al. (2022), both studies are going through a fixed-effect model and the results for both studies are negative toward GDP growth. Rouksar-Dussoyea et al. (2017), a case study of 6 European Countries, shows inflation has an insignificant impact on GDP growth. However, Najafi Bousari et al. (2022) have found out that inflation has brought a significant effect on the GDP growth of Iran.

Throughout ARDL estimation, there is a short-run and long-run relationship between inflation and GDP growth in the case study of Pakistan. By having research from January 1991 to May 2020, the researchers also observed that inflation harms GDP growth and suggest that a low inflation rate is more necessary in boosting the country growth of Pakistan, especially during that tough period of the Covid-19 pandemic (Hayat et al., 2021). Furthermore, a study of Nigeria using ARDL and VECM approaches showed a significant positive relationship between inflation rate and GDP growth in the short run and long run. (Enejoh & Tsauni, 2017).

There is an interesting finding regarding inflation's sensitivity to growth rate changes being greater than growth's sensitivity to inflation rate changes. There are significant policy implications for these findings. Contrary to the international lending agencies' policy

recommendations, attempts to bring inflation to a very low level or to zero are likely to have a negative impact on economic growth. Nonetheless, accelerating economic development can overheat the economy to the point where inflation becomes unpredictable, unstable and uncertain. Thus, these economies are precariously balanced. (Mallik, 2001).

2.3 The Study's Empirical Framework



Based on the empirical studies, we proposed a framework as above, the dependent variable will be the GDP growth rate in Malaysia, while the independent variable is the exchange rate, interest rate and inflation rate. The reason for adopting this research is to determine the relationship between the exchange rate, interest rate and inflation rate with the GDP growth rate in Malaysia.

2.4 Hypothesis Testing

This research is made to investigate how the exchange rate, interest rate and inflation rate will influence the GDP growth rate during the Covid-19 pandemic. Thus, there are 3 hypotheses that were made as shown below.

Hypothesis 1:

- H_0: There is no significant relationship between the exchange rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic.
- H_1: There was a significant relationship between the exchange rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic.

The study is expected to show the exchange rate significantly affected the GDP growth rate in a negative relationship in the Malaysian economy during the Covid-19 pandemic. A strong

exchange rate will result in a declining trend in economic growth as exports will be more expensive and citizens will prefer to spend more on imported goods.

Hypothesis 2:

- H_0: There is no significant relationship between interest rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic.
- H_1: There was a significant relationship between interest rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic.

It is expected to have a negative relationship between the interest rate and GDP growth rate of the Malaysian economy during the Covid-19 pandemic. It was assumed that keeping a low-interest rate would boost the economic growth of a country, especially during the Covid-19 pandemic.

Hypothesis 3:

- H_0: There is no significant relationship between the inflation rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic.
- H_1: There is a significant relationship between the inflation rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic.

It is expected to have a negative relationship between the inflation rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic. When a low inflation rate exists during a tough situation, it will also result in a high GDP growth rate in Malaysia.

Table 2.4: Expected relationship with GDP

Variables	Unit Measurement	Expected Relationship with GDP
Exchange Rate	Percentage changes in the exchange rate	Negative
Interest Rate	Percentage changes in the interest rate	Negative
Inflation Rate	Percentage changes in the inflation rate	Negative

2.5 Gap of Literature Review

Since the outbreak of Covid-19, most researchers have explored the studies regarding the impact of the issue on the Malaysian economy. After research, it was found that there is a huge effect of the Covid-19 pandemic on the economy of Malaysia. After reviewing many studies, we found that most of the research by the researchers did not use the performance of economic indicators as a variable to understand the effect of Covid-19 on the Malaysian economy. Therefore, the impact of Covid-19 on the economy of Malaysia will be shown in our research in the form of different economic indicators.

In addition, after research, it is found that most of the researchers' research direction is the impact of Covid-19 on the industry rather than the impact on the Malaysian economy. Therefore, at the time of completing the research, there was a lack of sufficient references to support our theories and directions.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This analysis is a strategy to review and analyse data to provide the information from the data. Throughout this research, the EViews 12 software will be used by analyzing the data. This will be able to let researchers have a better understanding of the link between the indicators.

3.2 Data Collection Method

In the research, time series analysis will be used and applied to investigate the relationships of independent variables toward the economic growth of Malaysia by applying secondary data. The data set and information that is used in the study will be collected from journal articles and online databases such as DOSM and Bank Negara Malaysia (BNM). This study will focus on the Covid-19 period. Therefore, the data collected would be from Jan 2020 until March 2022 on a monthly basis, the total observation will be 27. After that, the data will be then transmitted to EViews 12 software for data investigation. To assure the accuracy of the data, recent data is collected by referring to the source of data which is from DOSM and BNM.

3.3 Variables Measurement

Table 3.3: Variable Measurement

Variables	Unit of measurement	Data sources	Data period
Exchange Rate	Changes in percentage (Δ%)	BNM	Jan 2020-Mar 2022
Interest Rate	Changes in percentage (Δ%)	BNM	Jan 2020-Mar 2022
Inflation Rate	$\frac{CPI_{current} - CPI_{previous}}{CPI_{previous}} x100\%$	DOSM	Jan 2020-Mar 2022
GDP Growth rate	Changes in percentage (Δ%)	DOSM	Jan 2020-Mar 2022

Exchange Rate:

It is a measurement that is used to estimate the changes of the exchange rate in a country. It is a determinant of a country's economic performance. A higher exchange rate is expected to worsen a country's trade balance, whereas a lower exchange rate will improve it.

Interest rate:

It is a measurement of the average lending rate. The cost of borrowing and rate of return for the lender are both indicated by the interest rate. Interest rates can also represent the number of earnings of a bank. When interest rates are high, it means more cost of borrowing money; when interest rates are low, lesser cost of borrowing money.

Inflation Rate:

It is calculated based on the CPI in the current period over the CPI in the base period in terms of percentage rate (Raphael Zeder, 2017). In simple form, it is a measurement to estimate the living costs of citizens. A high inflation rate indicates that the price of commodities has been raised at that moment.

GDP Growth Rate:

It reflected the economic growth of a country by comparing the latest GDP with the previous GDP in percentage rate. The percentage of growth rate can be in positive and negative value by the observation of whether there is a growing or declining trend in GDP. It will be used to measure how fast a country is growing in its economy which is affected by various kinds of variables (Fern et al., 2022).

3.4 Multiple Regression Model

This model assists to analyse the relationship between each dependent variable with several independent variables. It was applied to forecast the value of the single dependent variable by having values on the independent variables.

$$Y = \beta_1 X_1 - \beta_2 X_2 + \beta_3 X_3 + \mu$$

Y = GDP Growth Rate

X_1 = Exchange Rate

X_2 = Interest Rate

X_3 = Inflation Rate

μ = error term

3.5 Data Analysis Techniques

3.5.1 Unit Root Test

Unit root test is a stochastic trend in time series. The variation is hardly predictable. Macroeconomic variables such as GDP, exchange rate, interest rate and the inflation rate will show an upward or downward movement strongly over time without the tendency to return to a fixed mean. So, they are non-stationary. In econometrics, we will apply the unit root test to check the stationary status of the time series variable. There are two widely used stationary test methods which are Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP).

3.5.1.1 Augmented Dickey-Fuller (ADF) Test

One of the common methods to test the unit root. It is the expansion of the Dickey-Fuller test by adding the lag inside the model to minimize the autocorrelation problem.

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta y_{t-i} + \mu_t$$

The augmentation (p>0) will not have the effect of the asymptotic distribution of the test statistic.

The hypothesis testing:

H_0 = series contains a unit root H_1 = series is stationary

3.5.1.2 Phillips-Perron (PP) Test

Phillips-Perron tests an alternative model to test for unit roots. This test is likely to be the ADF test, but to account for autocorrelated residuals, the automated correction was added to the Dickey-Fuller technique. PP test This test will give the same conclusion as Augmented Dickey-Fuller. The hypothesis testing is the same as the augmented Dickey-Fuller test.

3.5.2 Autoregressive Distributed Lag (ARDL) Model

ARDL bound test is used to observe the long-run relationship existing in the series (Pesaran et al., 2001). Accordingly, the ARDL is used to find the integration, which was also a suitable fit with tiny sample sizes of data. Recently, the ARDL approach has grown in popularity in some empirical studies to look forward to the economic growth in Malaysia such as Gamal al et. (2021), Majid (2008), and Ali et al (2022). Those empirical studies use the ARDL model in order to look forward long run cointegration of the variables. Therefore this study was also using the ARDL model to find out the long-run relationship between the exchange rate, inflation rate and interest rate toward Malaysia's GDP growth rate. Other than that, this study was using only 27 observation data. Therefore, the ARDL model can be used in this research as it is a good fit for small sample sizes of data. Besides that, the lag selection criteria for using the ARDL bound test were determined in this study using AIC, which suggests that the model produces superior results overall. The lag selection criteria for using the ARDL bound test are all determined using the AIC, which suggests that the model performs better.

The ARDL model is appropriate for time series with mixed order of integration and non-stationary time series. The model needs a long enough lag to reflect the typical data creation process for a given modelling framework. When I (0), I (1), or mutual cointegration are used as the model's inputs, ARDL fits the independent variable. However, it is impossible if I (2) is present in any variables. This will be one of the ARDL model's presumptions because the model will not operate when the variables are stationary at I(2).

To determine the relationship between dependent and independent, the following model was constructed as

$GDP_t = ER + Int + Inf + \in_t$ – Equation1

Where GDP represents the GDP growth rate in Malaysia, while t represents the period from Jan2020 until March 2022. ER represents exchange rate, Int represents interest rate and Inf represents inflation. $\in_t$ represents the error term. Equation 1 can be written in ARDL form as follows:

$\Delta GDP_t = \Delta GDP_{t-k} + \Delta Int_{t-k} + \Delta Inf_{t-k} + \lambda GDP_{t-1} + \lambda Int_{t-1} + \lambda Inf_{t-1} + \in_t$ – equation 2

Where Δ shows the first different, $\in_t$ show the white noise. The Akaike information criterion (AIC) is applied in this research to determine the lag length.

3.5.3 Stability test for CUSUM & CUSUMSQ

The short-run and long-run coefficients suggested by Brown et al. (1975) owing to the occurrence of structural changes in all variables due to single or many structural breakdowns were examined using cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests. These tests, according to earlier research (Pesaran & Shin 1995; Pesaran et al. 2001), show the ARDL model's high level of fitness. The residual of ECM is plotted using these tests. The results imply that the ARDL model's coefficients are stable if the statistical data in the plot falls below critical bounds at a 5% significant value.

3.6 Diagnostic Checking

3.6.1 Multicollinearity

The variables that are highly correlated to each other in the econometrics model will cause the problem of multicollinearity. The high correlation will hinder the independent variable by showing its effect and relationship on the dependent variables. Multicollinearity problems cause the statistical inference to become inaccurate. Therefore, the multicollinearity increases in the R^2 of the independent variables. Thus, the parameter with large variance indicates that the standard error is high, and the smaller test statistic value will be obtained, the confidence interval obtained will be larger, and there will be an increasing probability that the false hypothesis will not be rejected.

The method to detect multicollinearity problems is when obtaining a high R^2 was associated with some significant t-ratios, it meant that significance was detected in general statistics, but not in individual statistics. Besides that, pairwise correlation. Its range is from -1 to 1, where -1 is a negative perfect correlation and 1 is a positive strong correlation. Furthermore, to detect multicollinearity problems by using VIF and TOL.

$$VIF = \frac{1}{(1 - R^2_{X_1X_2})} \; TOL_j = \frac{1}{VIF_j} = \left(1 - r^2_{X_2X_3}\right)$$

Table 3.6.1: VIF & TOF Result

VIF

VIF value	Interpretation
VIF=1	No multicollinearity found
1<VIF<10	No series multicollinearity found
VIF=∞	Perfectly multicollinearity found
VIF>10	Serious multicollinearity found

TOL

TOL value	Interpretation
TOL=1	No multicollinearity
TOL close to 0	Serious multicollinearity
TOL close to 1	No serious multicollinearity

VIF and TOL which equal to 1 will show that there is no multicollinearity while there will exist a high multicollinearity problem in the model when VIF value is greater than 10 or TOL value is closer to 0.

3.6.2 Heteroscedasticity

Heteroscedasticity used to describe the situation of the error variance and this caused by the outliers present in the data. Heteroscedasticity may significantly affect the result of the regression model, especially if the data set is small.

Breusch-Pagan test is used to detect the heteroscedasticity in linear regression model

The hypothesis is as following:

H_0: $\alpha_2 = \alpha_3 = \alpha_4 = 0$ (There is homoscedasticity.)

H_1 : At least one $\alpha \neq 0$. (There is heteroscedasticity.)

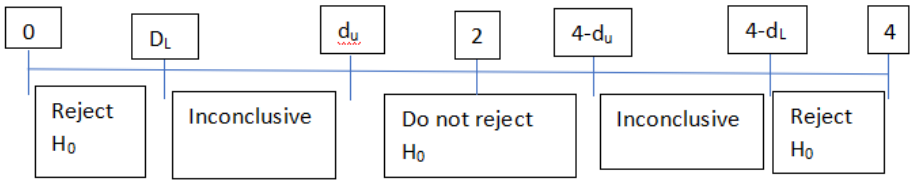
If Breusch-Pagan test's p-value is less than alpha value, H_0 is rejected. Hence, there is sufficient evidence to conclude there is existence of heteroscedasticity.

3.6.3 Autocorrelation

When the error terms are correlated, it will show that they are dependent with each other in previous data. By using Durbin Watson d Test is estimated residual in the regression analysis. The hypothesis is as below:

$H_0 : \rho = 0$ (There is no autocorrelation)

$H_1 : \rho \neq 0$ (There is autocorrelation)



There is autocorrelation if d falls below d_L or larger than 4-d_L. When d is between d_u and 4-d_u, do not reject H_0. Other than that, the result will be inconclusive.

3.6.4 Normality Test

To check whether the error term has fulfilled the normality assumption, Jarque-Bera (JB) test is used to measure the error term. The JB test can also measure the skewness, check for symmetry and kurtosis, and calculate the level of normal distribution. The Jarque-Bera (JB) test's formula is as follows:

$$JB = n\left(\frac{S^2}{6}\right) + \left(\frac{(K-3)^2}{24}\right)$$

The hypothesis testing is as below:

H_0: The error terms are normally distributed.

H_1: The error terms are not normally distributed.

By using the p-value approach to test the normality assumption, we will reject H_0 when the p-value is smaller than the significant value. Therefore, this will show that the error terms are not normally distributed.

3.7 Conclusion

To sum up everything in this chapter, it describes the data collection method, sources of data, variable measurement, and the methodologies that are used in this research. All the empirical results will apply to Eviews 12 to generate in the next chapter.

Chapter 4: Data Analysis

4.1 Descriptive Analysis

Table 4.1: Result of Descriptive Statistics

	GDP	Exchange Rate	Interest Rate	Inflation Rate
Mean	-0.0444	4.1755	-1.0873	0.1012
Median	-2.1	4.1662	0.8230	0.2402
Maximum	39.7	4.3553	1.5342	1.2438
Minimum	-28.8	4.0387	-6.0586	-2.7295
Standard deviation	11.769	0.0817	1.9225	0.7271
Skewness	0.9278	0.4153	-0.9022	-2.2938
Kurtosis	7.2464	2.8525	3.3040	10.0375
Observations	27	27	27	27

Based on table 4.1, the mean value of GDP is -0.04%, the median value is -2.1% and the standard deviation is 11.77%. Maximum and minimum values for GDP are 39.7% and -28.8%. Furthermore, the average means of the exchange rate is 4.18% with a median value of 4.17%. The values in the dataset deviate from the relative mean by 0.08% for the variable exchange rate. Furthermore, the largest value of the exchange rate is 4.36% while the lowest value of the exchange rate is 4.04%.

Moreover, the mean value of the interest rate is -1.087% and the median is -0.82%. Interest rates included a minimum value of -6.06% and a maximum value of 1.53%. The interest rate shows a standard deviation of 1.92%. In addition, the average value of the inflation rate is 0.1% and with a median value of 0.24%. Maximum and minimum inflation rates at 1.24% and -2.73%, respectively. For the inflation rate, the values in the dataset deviate at 0.73%.

4.2 Unit Root Test

Table 4.2: Results of ADF & PP Test

Variables	Test-Statistic Value			
	Intercept Without Trend		Intercept With Trend	
	Panel A: Level I(0)			
	ADF Test	PP Test	ADF Test	PP Test
GDP	-3.6710**	-2.6035	-4.6176***	-2.7692
Inflation	-3.2661**	-3.1447**	-3.4581*	-3.2642*
Exchange	-2.0034	-2.3210	-2.1362	-2.4778
Interest	-0.9744	-3.1906**	-2.1198	-5.2691***
	Panel B: First Difference I(1)			
GDP	-5.2946***	-5.1042***	-5.1537***	-4.5490***
Inflation	-5.1313***	-9.8543***	-5.0191***	-9.0943***
Exchange	-5.4812***	-5.48the 91***	-5.3357***	-5.3705***
Interest	-6.4688***	-11.0130***	-6.2627***	-10.4556***

Source: Computation Result from EViews.

Notes: *,** and *** represent the rejection of unit root at significance levels of 10%, 5% and 1% respectively.

Based on the result of the ADF unit root test those variables shown in the table which are GDP, inflation rate, exchange rate and interest rate at the level form and 1st difference for with trend and without trend. At the level from intercept without trend, interest rate and exchange rate are showing non-stationary since the null hypothesis cannot be rejected due to the fact that both p-values are greater than significance levels 1%, 5% and 10%. At the level form intercept with the trend, interest rate and exchange rate also show non-stationary. The null hypothesis cannot be rejected due to the p-value being greater than significance levels 1%, 5% and 10%. However, the level of GDP and inflation rate are stationary in both intercept with the trend and without trend. The p-value of GDP and inflation rate at the level of intercept without trend is less than the significance level 5% and 10%, hence the null hypothesis should be rejected.

At the first difference level, GDP and inflation are also shown as stationary data, but the exchange rate and interest rate are non-stationary data. Based on the ADF test, the p-value of GDP is below significance levels of 1%, 5% and 10% and the p-value of the inflation rate is below the significance level of 10%. The null hypothesis should be rejected, GDP and the inflation rate are stationary data. Moreover, the null hypothesis cannot be rejected in the ADF test of exchange rate and interest rate. It is due to the p-value of both rates being greater than the significance level of 1%, 5% and 10%.

On the other hand, the result of the Phillips Petron (PP) test is shown in the table. In level form, GDP and exchange rate are non-stationary both with the trend and without trend. It is because the p-value of GDP and exchange rate are greater than significance levels of 1%, 5% and 10%, hence the null hypothesis cannot be rejected. Besides, based on the PP test result in inflation rate and interest rate are stationary in both intercepts with a trend and without a trend. It is due to the p-value of both rates being less than the significance level of 5% and 10%. According to the PP test, at the first difference form, all the variables are stationary in both intercepts with the trend and without the trend. Since the p-value for the variables is lesser than significance levels 1%, 5% and 10%. Hence, the result in table 4.2 shows that all variables, GDP, inflation, interest rate and exchange rate are stationary in order of integration of I(1) as all p values are lower than significant levels of 1%, 5% and 10%.

4.3 Autoregressive Distributed Lag (ARDL) Model

After determining that the variables the exchange rate, interest rate, inflation rate and GDP growth rate are stationary at I (1), we employ the Autoregressive Distributed Lag(ARDL) Model in order to investigate the long-run relationship between the variables.

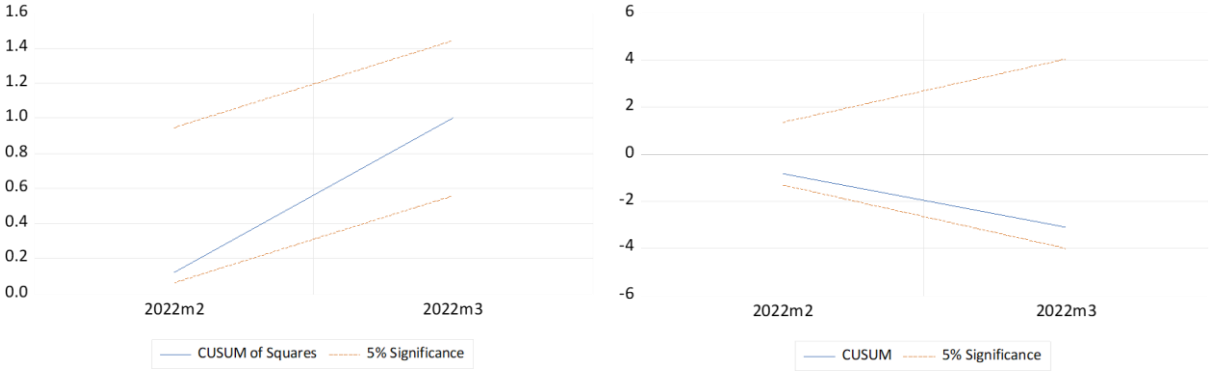
Table 4.3.1: Result of ARDL Long Run Form & Bound Test

F-Bounds Test			Null Hypothesis: No Levels Relationship	
Test Statistic	**Value**	**Significance Level**	**I(0)**	**I(1)**
			Asymptotic: n = 1000	
F-Statistic	10.15996	10%	3.47	4.45
k	3	5%	4.01	5.07
		1%	5.17	6.36

Table 4.3.2: ARDL Model (4,4,4,4)

Level Equation		
Variable	**Coefficient**	**Probability**
Exchange Rate	-353.2730	0.0381
Inflation Rate	-36.01426	0.0769
Interest Rate	-29.39994	0.0485
Residual Diagnostic Test Result		
CUSUM	Stable	
CUSUMSQ	Stable	

Graph 4.3: CUSUM & CUSUMSQ



Based on table 4.3.1, it showed that the existence of a long run relationship between independent variables and dependent variables since the t-statistic value of 10.16 is greater than significant levels of 1%, 5% and 10%.

According to table 4.3.2, the coefficient of the exchange rate, inflation rate and interest rate are -353.27, -36.01 and -29.40 respectively. It indicates that exchange rate, interest rate (Taderera et al., 2021) and inflation rate (Hoang & Tien, 2022) have a negative relationship with GDP. Moreover, the exchange rate is significant in the long run relationship between GDP, since the P-value is 0.0381, which is less than the significance level 5%. Besides, the p-value for inflation rate is 0.0769 lesser than significance level 10%, it shows that inflation rate is significant to GDP in long run. Interest rate shows long run significance to the GDP, since the p-value 0.0485 is lesser than significance level 5%.

Based on the graph 4.3, the results of CUSUM and CUSUMSQ show that both are in stable condition. The blue lines which represent CUSUM and CUSUM of Squares are in between the significance level of 5% over the time to confirm the stability and good fitness of the ARDL model.

4.4 Diagnostic checking

Diagnostic testing is crucial to find any potential errors in our data collection in order to guarantee that the findings are correct and trustworthy. This section included multicollinearity, heteroscedasticity, autocorrelation, and normality tests.

4.4.1 Multicollinearity

In order to test the multicollinearity, pairwise correlation, VIF and TOL will be the main indicator to detect the problem.

4.4.1.1 Pairwise correlation

Table 4.4.1.1: Result of Pairwise Correlation

	GDP	Exchange Rate	Interest Rate	Inflation Rate
GDP	1	-0.4756	0.4214	0.4059
Exchange Rate	-0.4756	1	-0.6174	-0.4743
Interest Rate	0.4214	-0.6174	1	0.2014
Inflation Rate	0.4059	-0.4743	0.2014	1

According to the table above there is not strong positive correlation or strong negative correlation among the variables as the value is not close to 1 or -1. Hence, there is no significant multicollinearity between variables during the Covid-19 period.

4.4.1.2 Variance Inflation Factor (VIF) and Tolerance (TOL)

Table 4.4.1.2: Result of Variance Inflation Factor (VIF) and Tolerance (TOL)

Independent variable	VIF	TOL=1/VIF
C	NA	
Exchange Rate	2.0357	0.4912
Inflation Rate	1.3131	0.7616
Interest Rate	1.6445	0.6081

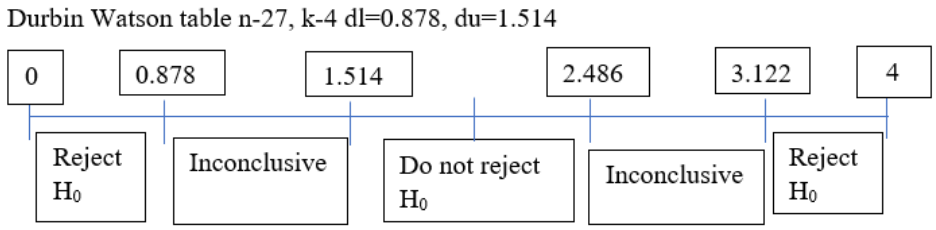
According to the table above each independent variable by referring to all of the VIF value are in the middle of 1 and 10, therefore it shows that there is no severe multicollinearity found while referring to TOL value, all of the value is closer to 1 which also indicate did not exhibit serious multicollinearity.

4.4.2 Heteroscedasticity, Autocorrelation & Normality Test

Table 4.4.2: Results of Heteroscedasticity, Autocorrelation & Normality Test

Diagnostics Tests	P-value / T-stat value	Outcome
Breusch-Pagan-Godfrey	0.7169 (p-value)	Problem of heteroscedasticity - No
Durbin-Watson	1.7003 (t-statistic value)	Problem of autocorrelation - No
Jarque-Bera Test	0.0000 (p-value)	Problem of normality - No

Based on heteroskedasticity tests, there is no heteroscedasticity in the model. Since the probability of Chi-square (0.7169) is greater than the significance level of 5% and 10%. There is enough evidence to reject the null hypothesis. Hence, the model is having homoscedasticity that shows a good regression model.



Test statistic value = 1.7003

To define the autocorrelation problem in the model, Durbin Watson test is used in this research. In this study, the test statistic value is 1.7003 which is in between 1.514 and 2.486 shows the result that the model is free from autocorrelation problems.

Based on the normality test, the P-value is 0, which is less than the significance level of 1%, 5% and 10%. Hence, there is sufficient evidence to conclude that the error term in the model is not normally distributed.

CHAPTER 5: DISCUSSION, RECOMMENDATION & CONCLUSION

5.0 Introduction

By contrasting the results of the test with the findings of the literature review in Chapter 2, we will provide the key conclusions from our study from Chapter 4 in this chapter. To enhance the information in this research report, the study's limits, suggestions for more research, and findings will be presented.

5.1 Discussion of Major Findings

5.1.1 Exchange Rate

According to the test results in Chapter 4, it shows that there is a relationship between the exchange rate and the GDP growth rate. It brings out the result that explains the increase in exchange rate by 1%, the GDP growth rate will drop by 353.2730, ceteris paribus. The coefficient of the exchange rate is –353.2730 indicates the relationship between these 2 variables is negative which meets our expectations in the study. The result will be the same as the research studies done by two researchers (Ayodele, 2014; Ahmad & Ali, 2013). Both kinds of research have acquired the result that the exchange rate has a significantly negative influence on the GDP growth of the sample countries being observed. According to Ayodele (2014), when the currency of a country faces depreciation, the exports will be cheaper and thus demands for exports will rise which will result in a growing trend of GDP growth of the country.

5.1.2 Interest Rate

Besides that, the result also shows that interest rates are also significant toward the GDP growth rate. When the interest rate increases by 1 %, the GDP growth rate will decrease by 29.39994, ceteris paribus. The result of the relationship between interest rate and GDP growth rate met our expectations, which is a negative relationship, since the coefficient of the interest rates was –29.39994 . This result will be the same as the result conducted by Semuel & Nurina (2014). The result of their studies has discovered that the interest rate will have a negative relationship with GDP growth. According to the International Fisher Effect, nations with high-interest rates will also have high rates of inflation (Ersan, 2008). Additionally, inflation contributes to a rise in poverty. Significant inflation will cause a company's production expenses to tend to grow

and production capabilities to decrease, resulting in a decline in product output. A decrease in production will lead to a decrease in the GDP of the country (Semuel & Nurina, 2014).

5.1.3 Inflation Rate

Furthermore, the results obtained show that there is a significant inflation rate and GDP growth rate. While the inflation rate increases by 1 %, the GDP growth rate will decrease by 36.01426, ceteris paribus. The coefficient of the inflation rate is –36.01426, the negative sign means there exists a negative relationship toward GDP growth. The result is not only the same as our expectations but also matches with some studies conducted by some researchers (Hoang & Tian, 2022; Nurul & Azmi, 2017; Najafi Bousari et al., 2022). The results of their studies have discovered that inflation rate has a significantly negative impact towards the GDP growth rate in the countries as observed. According to Ivory Research (2019), high inflation indicates a low purchasing power of citizens. With a low purchasing power, consumption will be reduced and thus affect the GDP growth rate to decline.

5.2 Implication of Study

This study was conducted to find out the impact of the Covid-19 pandemic on Malaysia's economy. The study topic of Covid-19 in an aspect of different views has been conducted by other researchers such as the tourism sector etc. The study of the impact Covid-19 pandemic on Malaysia was less. Therefore, this study was carried out to fill the research gap in the aspect of the Covid-19 pandemic in Malaysia. Hopefully, this study will help future researchers with some information about the impact of covid-19 on Malaysia's economy. Furthermore, policymakers and investors also could have a study report for references in order to help them to make decision making to prevent uncertainty.

Besides that, allow policy-makers, such as the government and the Central Bank of Malaysia, to discover the factors that have a substantial impact on Malaysia's economic growth based on the research topic. It is abundantly obvious from Chapter 4 that Malaysia's GDP growth rate will be significantly impacted by the exchange rate, interest rate, and inflation rates. To prepare for the next crisis, the government and policymakers may decide whether Malaysia's economy would grow or decrease in different economic conditions. Moreover, the results of this study might be used as a reference by the central bank and policymakers to adjust fiscal and monetary

policies such as adjusting the OPR rate, having the stimulus packages and so on, particularly in terms of economic development, in order to assist the recovery and reformation of the Malaysian economy if the crisis happened.

Other than that, this study may serve as inspiration for similar research in the future. Future researchers can assess what variables should be in their studies on related topics by using this study as a guide. For example, macroeconomic factors which consist of the level of the unemployment rate, price, human capital, money demand and supply and other macroeconomic indicators can be added on to find out the relationships with the GDP growth rate.

Last but not least, the individuals who refer to capitalists and stakeholders who are interested in the Malaysian economy will also find this study to be essential. This study details Malaysia's GDP growth in response to the pandemic. Foreign investors who are interested in investing in Malaysia will be able to understand the connection and significance of the chosen variables. They can use this study as a guide to get a clear understanding of how Malaysia's GDP growth rate and the variables relate in order to make accurate investment choices and determine the best time to invest.

5.3 Limitation of Study

Based on our study, a few limitations we faced in conducting this study are to be mentioned in this topic. In this study, we have faced the limitation of fewer sample data acquired. Since Covid-19 has just occurred around 2 years in the world, we are just able to estimate around 27 sample periods of monthly data from January 2020 to March 2022 for the cases in Malaysia. Thus, although we still can get a significant result in the study of the impact of Covid-19 on the economy of Malaysia, the results of this study may not be appropriate as well to be a reference as fewer data are included. Besides that, this study only focuses on Malaysia’s economy compared to other research which conducts the study that compares developing or developed countries. In addition, the difficulty to develop theory in our study is one of the major problems that we face. We tried to find the theories that can fit our variables, but the theories we found did not fit our objective of this study.

5.4 Recommendation

Researchers would want to recommend a few adjustments if future researchers were to design this study again in the future. Most importantly, this study advises extending the time frame in order to collect involvement across the whole research process, from original conception through dissemination. It is advised that future researchers do comparisons between the pre-, during-, and post-Covid-19 pandemic periods to advance their research. This is due to the fact that the research was done when the pandemic was still active. By having the comparisons, future researchers will be able to compare data from three distinct time periods while also increasing the sample size and time window. Besides that, future researchers may also recommend using other indicators or variables to carry out the study. This is because there is also another indicator or variable that will bring impact the economy of the country. For example, GDP may also be impacted by non-economic or political factors. Therefore, future researchers will be able to make a comparison between the research. Additionally, to evaluate and adjust for measurement mistakes and improve the accuracy of the data, researchers can also include several indicators in the study.

5.5 Conclusion

In short, Covid-19 has brought many effects on the whole world including Malaysia. The exchange rate, interest rate and inflation rate have also been impacted while the effects of variables represented the result of GDP growth rate of Malaysia during the Covid-19 pandemic.

In this study, we have gone through the discussion about the relationship between the exchange rate, interest rate, inflation rate and GDP growth rate of Malaysia during the Covid-19 pandemic which covers the monthly sample period from January 2020 to March 2022. As per the discussion above, the result has indicated that there exist negative relationships between all variables observed and showed that three independent variables have a long-run relationship towards the GDP growth rate of Malaysia.

Although this study has faced the limitation of lacking a data sample period, other researchers may be able to observe more sample periods which will be more accurate in the future as time goes by. We also encourage future researchers to have comparisons of past, present and post Covid-19 pandemics and cover more variables in order to detect the impacts more obviously as references for policy implications in future.

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APPENDIXES

Appendix 4.1 Descriptive Analysis

	GDP_GRO...	EXCHANGE...	INTEREST_...	INFLATION...
Mean	-0.044444	4.175499	-1.087333	0.101232
Median	-2.100000	4.166202	-0.822976	0.240192
Maximum	39.70000	4.355341	1.534158	1.243781
Minimum	-28.80000	4.036868	-6.058575	-2.729529
Std. Dev.	11.76927	0.081749	1.922491	0.727090
Skewness	0.927769	0.415292	-0.902248	-2.293752
Kurtosis	7.246428	2.852516	3.304018	10.03751
Jarque-Bera	24.15956	0.800573	3.767211	79.39327
Probability	0.000006	0.670128	0.152041	0.000000
Sum	-1.200000	112.7385	-29.35799	2.733256
Sum Sq. Dev.	3601.407	0.173754	96.09522	13.74515
Observations	27	27	27	27

Appendix 4.2 Unit Root Test

ADF Test: Exchange rate

Null Hypothesis: EXCHANGE RATE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.003399	0.2836
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXCHANGE RATE)
Method: Least Squares
Date: 07/23/22 Time: 13:56
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXCHANGE RATE(-1)	-0.264243	0.131897	-2.003399	0.0566
C	1.107851	0.550876	2.011070	0.0557

R-squared	0.143273	Mean dependent var	0.004442
Adjusted R-squared	0.107577	S.D. dependent var	0.058918
S.E. of regression	0.055659	Akaike info criterion	-2.865337
Sum squared resid	0.074351	Schwarz criterion	-2.768560
Log likelihood	39.24938	Hannan-Quinn criter.	-2.837468
F-statistic	4.013607	Durbin-Watson stat	1.581972
Prob(F-statistic)	0.056550		

Null Hypothesis: D(EXCHANGE_RATE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.481247	0.0001
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXCHANGE_RATE,2)
Method: Least Squares
Date: 07/23/22 Time: 13:57
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXCHANGE_RATE(-1))	-1.014337	0.185056	-5.481247	0.0000
C	-0.000815	0.010935	-0.074577	0.9412

R-squared	0.566398	Mean dependent var	-0.005380
Adjusted R-squared	0.547546	S.D. dependent var	0.081046
S.E. of regression	0.054515	Akaike info criterion	-2.904051
Sum squared resid	0.068354	Schwarz criterion	-2.806541
Log likelihood	38.30064	Hannan-Quinn criter.	-2.877006
F-statistic	30.04407	Durbin-Watson stat	2.218784
Prob(F-statistic)	0.000014		

Null Hypothesis: EXCHANGE_RATE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.136213	0.5030
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXCHANGE_RATE)
Method: Least Squares
Date: 07/23/22 Time: 14:05
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXCHANGE_RATE(-1)	-0.290917	0.136183	-2.136213	0.0435
C	1.236703	0.573726	2.155563	0.0418
@TREND("2020M01")	-0.001294	0.001503	-0.861081	0.3981

R-squared	0.170030	Mean dependent var	0.004442
Adjusted R-squared	0.097858	S.D. dependent var	0.058918
S.E. of regression	0.055961	Akaike info criterion	-2.820142
Sum squared resid	0.072029	Schwarz criterion	-2.674977
Log likelihood	39.66185	Hannan-Quinn criter.	-2.778340
F-statistic	2.355916	Durbin-Watson stat	1.582196
Prob(F-statistic)	0.117279		

Null Hypothesis: D(EXCHANGE_RATE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.335660	0.0012
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXCHANGE_RATE,2)
Method: Least Squares
Date: 07/23/22 Time: 14:06
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXCHANGE_RATE(-1))	-1.007917	0.188902	-5.335660	0.0000
C	-0.010525	0.024363	-0.431987	0.6700
@TREND("2020M01")	0.000691	0.001543	0.447995	0.6585

R-squared	0.570318	Mean dependent var	-0.005380
Adjusted R-squared	0.531256	S.D. dependent var	0.081046
S.E. of regression	0.055488	Akaike info criterion	-2.833133
Sum squared resid	0.067736	Schwarz criterion	-2.686868
Log likelihood	38.41416	Hannan-Quinn criter.	-2.792565
F-statistic	14.60033	Durbin-Watson stat	2.260311
Prob(F-statistic)	0.000092		

PP Test: Exchange Rate

Null Hypothesis: EXCHANGE_RATE has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.321034	0.1732
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.002860
HAC corrected variance (Bartlett kernel)	0.004353

Phillips-Perron Test Equation
Dependent Variable: D(EXCHANGE_RATE)
Method: Least Squares
Date: 07/23/22 Time: 14:08
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXCHANGE_RATE(-1)	-0.264243	0.131897	-2.003399	0.0566
C	1.107851	0.550876	2.011070	0.0557

R-squared	0.143273	Mean dependent var	0.004442
Adjusted R-squared	0.107577	S.D. dependent var	0.058918
S.E. of regression	0.055659	Akaike info criterion	-2.865337
Sum squared resid	0.074351	Schwarz criterion	-2.768560
Log likelihood	39.24938	Hannan-Quinn criter.	-2.837468
F-statistic	4.013607	Durbin-Watson stat	1.581972
Prob(F-statistic)	0.056550		

Null Hypothesis: D(EXCHANGE_RATE) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.489135	0.0001
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.002734
HAC corrected variance (Bartlett kernel)	0.002694

Phillips-Perron Test Equation
Dependent Variable: D(EXCHANGE_RATE,2)
Method: Least Squares
Date: 07/23/22 Time: 14:09
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXCHANGE_RATE(-1))	-1.014337	0.185056	-5.481247	0.0000
C	-0.000815	0.010935	-0.074577	0.9412

R-squared	0.566398	Mean dependent var	-0.005380
Adjusted R-squared	0.547546	S.D. dependent var	0.081046
S.E. of regression	0.054515	Akaike info criterion	-2.904051
Sum squared resid	0.068354	Schwarz criterion	-2.806541
Log likelihood	38.30064	Hannan-Quinn criter.	-2.877006
F-statistic	30.04407	Durbin-Watson stat	2.218784
Prob(F-statistic)	0.000014		

Null Hypothesis: EXCHANGE_RATE has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.477799	0.3352
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.002770
HAC corrected variance (Bartlett kernel)	0.004428

Phillips-Perron Test Equation
Dependent Variable: D(EXCHANGE_RATE)
Method: Least Squares
Date: 07/23/22 Time: 14:10
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXCHANGE_RATE(-1)	-0.290917	0.136183	-2.136213	0.0435
C	1.236703	0.573726	2.155563	0.0418
@TREND("2020M01")	-0.001294	0.001503	-0.861081	0.3981

R-squared	0.170030	Mean dependent var	0.004442
Adjusted R-squared	0.097858	S.D. dependent var	0.058918
S.E. of regression	0.055961	Akaike info criterion	-2.820142
Sum squared resid	0.072029	Schwarz criterion	-2.674977
Log likelihood	39.66185	Hannan-Quinn criter.	-2.778340
F-statistic	2.355916	Durbin-Watson stat	1.582196
Prob(F-statistic)	0.117279		

Null Hypothesis: D(EXCHANGE_RATE) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.370459	0.0011
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.002709
HAC corrected variance (Bartlett kernel)	0.002527

Phillips-Perron Test Equation
Dependent Variable: D(EXCHANGE_RATE,2)
Method: Least Squares
Date: 07/23/22 Time: 14:12
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXCHANGE_RATE(-1))	-1.007917	0.188902	-5.335660	0.0000
C	-0.010525	0.024363	-0.431987	0.6700
@TREND("2020M01")	0.000691	0.001543	0.447995	0.6585

R-squared	0.570318	Mean dependent var	-0.005380
Adjusted R-squared	0.531256	S.D. dependent var	0.081046
S.E. of regression	0.055488	Akaike info criterion	-2.833133
Sum squared resid	0.067736	Schwarz criterion	-2.686868
Log likelihood	38.41416	Hannan-Quinn criter.	-2.792565
F-statistic	14.60033	Durbin-Watson stat	2.260311
Prob(F-statistic)	0.000092		

ADF Test: GDP Growth Rate

Null Hypothesis: GDP_GROWTH_RATE has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.671005	0.0113
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP_GROWTH_RATE)
Method: Least Squares
Date: 07/09/22 Time: 14:09
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP_GROWTH_RATE(-1)	-0.669410	0.182351	-3.671005	0.0013
D(GDP_GROWTH_RATE(-1))	0.454253	0.190150	2.388917	0.0259
C	-0.305888	1.907571	-0.160355	0.8741

R-squared	0.388457	Mean dependent var	-0.008000
Adjusted R-squared	0.332862	S.D. dependent var	11.66712
S.E. of regression	9.529529	Akaike info criterion	7.458834
Sum squared resid	1997.862	Schwarz criterion	7.605099
Log likelihood	-90.23543	Hannan-Quinn criter.	7.499402
F-statistic	6.987278	Durbin-Watson stat	1.759321
Prob(F-statistic)	0.004474		

Null Hypothesis: D(GDP_GROWTH_RATE) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.294637	0.0003
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP_GROWTH_RATE,2)
Method: Least Squares
Date: 07/28/22 Time: 02:12
Sample (adjusted): 2020M04 2022M03
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP_GROWTH_RATE(-1))	-1.299727	0.245480	-5.294637	0.0000
D(GDP_GROWTH_RATE(-1),2)	0.483634	0.184715	2.618277	0.0161
C	0.514747	2.141893	0.240323	0.8124

R-squared	0.583917	Mean dependent var	0.504167
Adjusted R-squared	0.544290	S.D. dependent var	15.54370
S.E. of regression	10.49298	Akaike info criterion	7.655758
Sum squared resid	2312.153	Schwarz criterion	7.803014
Log likelihood	-88.86909	Hannan-Quinn criter.	7.694825
F-statistic	14.73534	Durbin-Watson stat	2.149010
Prob(F-statistic)	0.000100		

Null Hypothesis: GDP_GROWTH_RATE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.617593	0.0059
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP_GROWTH_RATE)
Method: Least Squares
Date: 07/28/22 Time: 02:13
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP_GROWTH_RATE(-1)	-0.846473	0.183315	-4.617593	0.0001
D(GDP_GROWTH_RATE(-1))	0.521755	0.176150	2.961995	0.0074
C	-9.004231	4.142118	-2.173823	0.0413
@TREND("2020M01")	0.615998	0.266109	2.314830	0.0308

R-squared	0.512778	Mean dependent var	-0.008000
Adjusted R-squared	0.443175	S.D. dependent var	11.66712
S.E. of regression	8.706086	Akaike info criterion	7.311568
Sum squared resid	1591.714	Schwarz criterion	7.506588
Log likelihood	-87.39460	Hannan-Quinn criter.	7.365659
F-statistic	7.367168	Durbin-Watson stat	1.942234
Prob(F-statistic)	0.001483		

Null Hypothesis: D(GDP_GROWTH_RATE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.153744	0.0019
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP_GROWTH_RATE,2)
Method: Least Squares
Date: 07/28/22 Time: 02:13
Sample (adjusted): 2020M04 2022M03
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP_GROWTH_RATE(-1))	-1.301070	0.252451	-5.153744	0.0000
D(GDP_GROWTH_RATE(-1),2)	0.484167	0.189454	2.555595	0.0188
C	0.229116	5.109661	0.044840	0.9647
@TREND("2020M01")	0.019700	0.318247	0.061900	0.9513

R-squared	0.583997	Mean dependent var	0.504167
Adjusted R-squared	0.521596	S.D. dependent var	15.54370
S.E. of regression	10.75107	Akaike info criterion	7.738900
Sum squared resid	2311.710	Schwarz criterion	7.935242
Log likelihood	-88.86679	Hannan-Quinn criter.	7.790989
F-statistic	9.358840	Durbin-Watson stat	2.147394
Prob(F-statistic)	0.000453		

PP Test: GDP Growth Rate

Null Hypothesis: GDP_GROWTH_RATE has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.603461	0.1051
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	97.39648
HAC corrected variance (Bartlett kernel)	91.97802

Phillips-Perron Test Equation
Dependent Variable: D(GDP_GROWTH_RATE)
Method: Least Squares
Date: 07/09/22 Time: 14:12
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP GROWTH RATE(-1)	-0.455446	0.171902	-2.649453	0.0140
C	-0.027152	2.014967	-0.013475	0.9894

R-squared	0.226296	Mean dependent var	0.088462
Adjusted R-squared	0.194058	S.D. dependent var	11.44197
S.E. of regression	10.27195	Akaike info criterion	7.570513
Sum squared resid	2532.309	Schwarz criterion	7.667290
Log likelihood	-96.41667	Hannan-Quinn criter.	7.598382
F-statistic	7.019599	Durbin-Watson stat	1.507881
Prob(F-statistic)	0.014038		

Null Hypothesis: D(GDP_GROWTH_RATE) has a unit root
Exogenous: Constant
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.104187	0.0004
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	128.8668
HAC corrected variance (Bartlett kernel)	25.71561

Phillips-Perron Test Equation
Dependent Variable: D(GDP_GROWTH_RATE,2)
Method: Least Squares
Date: 07/09/22 Time: 14:13
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP_GROWTH_RATE(-1))	-0.882419	0.206874	-4.265484	0.0003
C	-0.017877	2.367109	-0.007552	0.9940

R-squared	0.441671	Mean dependent var	-0.092000
Adjusted R-squared	0.417396	S.D. dependent var	15.50564
S.E. of regression	11.83523	Akaike info criterion	7.856656
Sum squared resid	3221.669	Schwarz criterion	7.954166
Log likelihood	-96.20820	Hannan-Quinn criter.	7.883701
F-statistic	18.19435	Durbin-Watson stat	1.821334
Prob(F-statistic)	0.000291		

Null Hypothesis: GDP_GROWTH_RATE has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.769191	0.2200
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	90.49768
HAC corrected variance (Bartlett kernel)	62.64469

Phillips-Perron Test Equation
Dependent Variable: D(GDP_GROWTH_RATE)
Method: Least Squares
Date: 07/09/22 Time: 14:13
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP_GROWTH_RATE(-1)	-0.539091	0.180669	-2.983858	0.0066
C	-5.094699	4.310794	-1.181847	0.2493
@TREND("2020M01")	0.373801	0.282298	1.324134	0.1985

R-squared	0.281099	Mean dependent var	0.088462
Adjusted R-squared	0.218586	S.D. dependent var	11.44197
S.E. of regression	10.11443	Akaike info criterion	7.573971
Sum squared resid	2352.940	Schwarz criterion	7.719135
Log likelihood	-95.46162	Hannan-Quinn criter.	7.615773
F-statistic	4.496634	Durbin-Watson stat	1.535052
Prob(F-statistic)	0.022475		

Null Hypothesis: D(GDP_GROWTH_RATE) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.548985	0.0068
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	128.3139
HAC corrected variance (Bartlett kernel)	35.89206

Phillips-Perron Test Equation
Dependent Variable: D(GDP_GROWTH_RATE,2)
Method: Least Squares
Date: 07/09/22 Time: 14:14
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP_GROWTH_RATE(-1))	-0.886032	0.211395	-4.191347	0.0004
C	-1.463350	5.279707	-0.277165	0.7842
@TREND("2020M01")	0.103270	0.335424	0.307878	0.7611

R-squared	0.444066	Mean dependent var	-0.092000
Adjusted R-squared	0.393527	S.D. dependent var	15.50564
S.E. of regression	12.07523	Akaike info criterion	7.932357
Sum squared resid	3207.848	Schwarz criterion	8.078622
Log likelihood	-96.15446	Hannan-Quinn criter.	7.972924
F-statistic	8.786533	Durbin-Watson stat	1.824811
Prob(F-statistic)	0.001568		

ADF Test: Interest Rate

Null Hypothesis: INTEREST_RATE has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.974381	0.7455
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INTEREST_RATE)
Method: Least Squares
Date: 07/28/22 Time: 02:17
Sample (adjusted): 2020M04 2022M03
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTEREST_RATE(-1)	-0.204534	0.209912	-0.974381	0.3415
D(INTEREST_RATE(-1))	-0.678275	0.240779	-2.817008	0.0106
D(INTEREST_RATE(-2))	-0.273828	0.199939	-1.369556	0.1860
C	0.011608	0.408817	0.028394	0.9776

R-squared	0.524577	Mean dependent var	0.179180
Adjusted R-squared	0.453263	S.D. dependent var	2.118367
S.E. of regression	1.566355	Akaike info criterion	3.886392
Sum squared resid	49.06938	Schwarz criterion	4.082734
Log likelihood	-42.63670	Hannan-Quinn criter.	3.938481
F-statistic	7.355929	Durbin-Watson stat	2.022454
Prob(F-statistic)	0.001644		

Null Hypothesis: D(INTEREST_RATE) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.468831	0.0000
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INTEREST_RATE,2)
Method: Least Squares
Date: 07/28/22 Time: 02:18
Sample (adjusted): 2020M04 2022M03
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INTEREST_RATE(-1))	-2.169587	0.335391	-6.468831	0.0000
D(INTEREST_RATE(-1),2)	0.342478	0.186889	1.832517	0.0811
C	0.259017	0.320018	0.809383	0.4274

R-squared	0.857011	Mean dependent var	0.101122
Adjusted R-squared	0.843393	S.D. dependent var	3.953317
S.E. of regression	1.564468	Akaike info criterion	3.849437
Sum squared resid	51.39875	Schwarz criterion	3.996694
Log likelihood	-43.19324	Hannan-Quinn criter.	3.888504
F-statistic	62.93244	Durbin-Watson stat	2.015743
Prob(F-statistic)	0.000000		

Null Hypothesis: INTEREST_RATE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.119836	0.5096
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INTEREST_RATE)
Method: Least Squares
Date: 07/28/22 Time: 02:19
Sample (adjusted): 2020M04 2022M03
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTEREST_RATE(-1)	-0.811222	0.382682	-2.119836	0.0474
D(INTEREST_RATE(-1))	-0.323590	0.297170	-1.088904	0.2898
D(INTEREST_RATE(-2))	-0.142075	0.201721	-0.704313	0.4898
C	-2.997995	1.669177	-1.796091	0.0884
@TREND("2020M01")	0.157636	0.085058	1.853280	0.0794

R-squared	0.597362	Mean dependent var	0.179180
Adjusted R-squared	0.512596	S.D. dependent var	2.118367
S.E. of regression	1.478923	Akaike info criterion	3.803558
Sum squared resid	41.55707	Schwarz criterion	4.048985
Log likelihood	-40.64269	Hannan-Quinn criter.	3.868670
F-statistic	7.047199	Durbin-Watson stat	1.886885
Prob(F-statistic)	0.001178		

Null Hypothesis: D(INTEREST_RATE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.262728	0.0002
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INTEREST_RATE,2)
Method: Least Squares
Date: 07/28/22 Time: 02:19
Sample (adjusted): 2020M04 2022M03
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INTEREST_RATE(-1))	-2.173003	0.346974	-6.262728	0.0000
D(INTEREST_RATE(-1),2)	0.344025	0.192714	1.785160	0.0894
C	0.210022	0.763293	0.275153	0.7860
@TREND("2020M01")	0.003394	0.047745	0.071081	0.9440

R-squared	0.857048	Mean dependent var	0.101122
Adjusted R-squared	0.835605	S.D. dependent var	3.953317
S.E. of regression	1.602900	Akaike info criterion	3.932518
Sum squared resid	51.38576	Schwarz criterion	4.128860
Log likelihood	-43.19021	Hannan-Quinn criter.	3.984607
F-statistic	39.96888	Durbin-Watson stat	2.011193
Prob(F-statistic)	0.000000		

PP Test: Interest Rate

Null Hypothesis: INTEREST_RATE has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.190586	0.0322
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	3.127850
HAC corrected variance (Bartlett kernel)	3.071095

Phillips-Perron Test Equation
Dependent Variable: D(INTEREST_RATE)
Method: Least Squares
Date: 07/28/22 Time: 02:20
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTEREST_RATE(-1)	-0.605670	0.189015	-3.204344	0.0038
C	-0.636183	0.419415	-1.516834	0.1424

R-squared	0.299634	Mean dependent var	0.047943
Adjusted R-squared	0.270453	S.D. dependent var	2.155149
S.E. of regression	1.840789	Akaike info criterion	4.132069
Sum squared resid	81.32409	Schwarz criterion	4.228846
Log likelihood	-51.71690	Hannan-Quinn criter.	4.159937
F-statistic	10.26782	Durbin-Watson stat	2.343154
Prob(F-statistic)	0.003801		

Null Hypothesis: D(INTEREST_RATE) has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-11.01304	0.0000
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	2.838643
HAC corrected variance (Bartlett kernel)	2.060414

Phillips-Perron Test Equation
Dependent Variable: D(INTEREST_RATE,2)
Method: Least Squares
Date: 07/28/22 Time: 02:21
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INTEREST_RATE(-1))	-1.625937	0.163882	-9.921407	0.0000
C	0.090577	0.351631	0.257592	0.7990

R-squared	0.810597	Mean dependent var	-0.058162
Adjusted R-squared	0.802362	S.D. dependent var	3.951178
S.E. of regression	1.756554	Akaike info criterion	4.041203
Sum squared resid	70.96608	Schwarz criterion	4.138713
Log likelihood	-48.51504	Hannan-Quinn criter.	4.068248
F-statistic	98.43431	Durbin-Watson stat	2.247456
Prob(F-statistic)	0.000000		

Null Hypothesis: INTEREST_RATE has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.269094	0.0013
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	2.021407
HAC corrected variance (Bartlett kernel)	2.025004

Phillips-Perron Test Equation
Dependent Variable: D(INTEREST_RATE)
Method: Least Squares
Date: 07/28/22 Time: 02:22
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTEREST_RATE(-1)	-1.065740	0.202251	-5.269380	0.0000
C	-3.622944	0.909517	-3.983373	0.0006
@TREND("2020M01")	0.182748	0.051505	3.548146	0.0017

R-squared	0.547381	Mean dependent var	0.047943
Adjusted R-squared	0.508023	S.D. dependent var	2.155149
S.E. of regression	1.511644	Akaike info criterion	3.772440
Sum squared resid	52.55658	Schwarz criterion	3.917605
Log likelihood	-46.04172	Hannan-Quinn criter.	3.814242
F-statistic	13.90769	Durbin-Watson stat	2.046052
Prob(F-statistic)	0.000110		

Null Hypothesis: D(INTEREST_RATE) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.45559	0.0000
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	2.802012
HAC corrected variance (Bartlett kernel)	2.268413

Phillips-Perron Test Equation
Dependent Variable: D(INTEREST_RATE,2)
Method: Least Squares
Date: 07/28/22 Time: 02:22
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INTEREST_RATE(-1))	-1.632178	0.166886	-9.780171	0.0000
C	-0.281338	0.780083	-0.360651	0.7218
@TREND("2020M01")	0.026606	0.049611	0.536293	0.5971

R-squared	0.813041	Mean dependent var	-0.058162
Adjusted R-squared	0.796045	S.D. dependent var	3.951178
S.E. of regression	1.784406	Akaike info criterion	4.108215
Sum squared resid	70.05030	Schwarz criterion	4.254480
Log likelihood	-48.35269	Hannan-Quinn criter.	4.148783
F-statistic	47.83653	Durbin-Watson stat	2.267175
Prob(F-statistic)	0.000000		

ADF Test: Inflation Rate

Null Hypothesis: INFLATION_RATE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.266116	0.0273
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION_RATE)
Method: Least Squares
Date: 07/28/22 Time: 02:23
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFLATION_RATE(-1)	-0.617205	0.188972	-3.266116	0.0033
C	0.066443	0.138270	0.480530	0.6352

R-squared	0.307709	Mean dependent var	0.009143
Adjusted R-squared	0.278864	S.D. dependent var	0.823533
S.E. of regression	0.699342	Akaike info criterion	2.196450
Sum squared resid	11.73790	Schwarz criterion	2.293226
Log likelihood	-26.55385	Hannan-Quinn criter.	2.224318
F-statistic	10.66751	Durbin-Watson stat	1.730101
Prob(F-statistic)	0.003271		

Null Hypothesis: D(INFLATION_RATE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.131326	0.0003
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION_RATE,2)
Method: Least Squares
Date: 07/28/22 Time: 02:23
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLATION_RATE(-1))	-1.067412	0.208019	-5.131326	0.0000
C	0.013207	0.171289	0.077102	0.9392

R-squared	0.533757	Mean dependent var	0.006443
Adjusted R-squared	0.513486	S.D. dependent var	1.227835
S.E. of regression	0.856422	Akaike info criterion	2.604511
Sum squared resid	16.86954	Schwarz criterion	2.702021
Log likelihood	-30.55639	Hannan-Quinn criter.	2.631556
F-statistic	26.33051	Durbin-Watson stat	1.973796
Prob(F-statistic)	0.000034		

Null Hypothesis: INFLATION_RATE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.458138	0.0655
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION_RATE)
Method: Least Squares
Date: 07/28/22 Time: 02:24
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFLATION_RATE(-1)	-0.679891	0.196606	-3.458138	0.0021
C	-0.210109	0.286763	-0.732693	0.4711
@TREND("2020M01")	0.020916	0.019026	1.099376	0.2830

R-squared	0.342272	Mean dependent var	0.009143
Adjusted R-squared	0.285078	S.D. dependent var	0.823533
S.E. of regression	0.696322	Akaike info criterion	2.222158
Sum squared resid	11.15188	Schwarz criterion	2.367323
Log likelihood	-25.88805	Hannan-Quinn criter.	2.263960
F-statistic	5.984436	Durbin-Watson stat	1.741191
Prob(F-statistic)	0.008082		

Null Hypothesis: D(INFLATION_RATE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.019092	0.0024
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION_RATE,2)
Method: Least Squares
Date: 07/28/22 Time: 02:25
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLATION_RATE(-1))	-1.067542	0.212696	-5.019092	0.0001
C	-0.004255	0.382454	-0.011126	0.9912
@TREND("2020M01")	0.001247	0.024287	0.051358	0.9595

R-squared	0.533813	Mean dependent var	0.006443
Adjusted R-squared	0.491432	S.D. dependent var	1.227835
S.E. of regression	0.875617	Akaike info criterion	2.684391
Sum squared resid	16.86752	Schwarz criterion	2.830656
Log likelihood	-30.55489	Hannan-Quinn criter.	2.724959
F-statistic	12.59568	Durbin-Watson stat	1.973680
Prob(F-statistic)	0.000226		

PP Test: Inflation Rate

Null Hypothesis: INFLATION_RATE has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.144658	0.0355
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.451458
HAC corrected variance (Bartlett kernel)	0.374744

Phillips-Perron Test Equation
Dependent Variable: D(INFLATION_RATE)
Method: Least Squares
Date: 07/28/22 Time: 02:25
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFLATION_RATE(-1)	-0.617205	0.188972	-3.266116	0.0033
C	0.066443	0.138270	0.480530	0.6352

R-squared	0.307709	Mean dependent var	0.009143
Adjusted R-squared	0.278864	S.D. dependent var	0.823533
S.E. of regression	0.699342	Akaike info criterion	2.196450
Sum squared resid	11.73790	Schwarz criterion	2.293226
Log likelihood	-26.55385	Hannan-Quinn criter.	2.224318
F-statistic	10.66751	Durbin-Watson stat	1.730101
Prob(F-statistic)	0.003271		

Null Hypothesis: D(INFLATION_RATE) has a unit root
Exogenous: Constant
Bandwidth: 19 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.854337	0.0000
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.674782
HAC corrected variance (Bartlett kernel)	0.056251

Phillips-Perron Test Equation
Dependent Variable: D(INFLATION_RATE,2)
Method: Least Squares
Date: 07/28/22 Time: 02:26
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLATION_RATE(-1))	-1.067412	0.208019	-5.131326	0.0000
C	0.013207	0.171289	0.077102	0.9392

R-squared	0.533757	Mean dependent var	0.006443
Adjusted R-squared	0.513486	S.D. dependent var	1.227835
S.E. of regression	0.856422	Akaike info criterion	2.604511
Sum squared resid	16.86954	Schwarz criterion	2.702021
Log likelihood	-30.55639	Hannan-Quinn criter.	2.631556
F-statistic	26.33051	Durbin-Watson stat	1.973796
Prob(F-statistic)	0.000034		

Null Hypothesis: INFLATION_RATE has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.264214	0.0945
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.428919
HAC corrected variance (Bartlett kernel)	0.294513

Phillips-Perron Test Equation
Dependent Variable: D(INFLATION_RATE)
Method: Least Squares
Date: 07/28/22 Time: 02:26
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFLATION_RATE(-1)	-0.679891	0.196606	-3.458138	0.0021
C	-0.210109	0.286763	-0.732693	0.4711
@TREND("2020M01")	0.020916	0.019026	1.099376	0.2830

R-squared	0.342272	Mean dependent var	0.009143
Adjusted R-squared	0.285078	S.D. dependent var	0.823533
S.E. of regression	0.696322	Akaike info criterion	2.222158
Sum squared resid	11.15188	Schwarz criterion	2.367323
Log likelihood	-25.88805	Hannan-Quinn criter.	2.263960
F-statistic	5.984436	Durbin-Watson stat	1.741191
Prob(F-statistic)	0.008082		

Null Hypothesis: D(INFLATION_RATE) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 18 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.094308	0.0000
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.674701
HAC corrected variance (Bartlett kernel)	0.061858

Phillips-Perron Test Equation
Dependent Variable: D(INFLATION_RATE,2)
Method: Least Squares
Date: 07/28/22 Time: 02:27
Sample (adjusted): 2020M03 2022M03
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLATION_RATE(-1))	-1.067542	0.212696	-5.019092	0.0001
C	-0.004255	0.382454	-0.011126	0.9912
@TREND("2020M01")	0.001247	0.024287	0.051358	0.9595

R-squared	0.533813	Mean dependent var	0.006443
Adjusted R-squared	0.491432	S.D. dependent var	1.227835
S.E. of regression	0.875617	Akaike info criterion	2.684391
Sum squared resid	16.86752	Schwarz criterion	2.830656
Log likelihood	-30.55489	Hannan-Quinn criter.	2.724959
F-statistic	12.59568	Durbin-Watson stat	1.973680
Prob(F-statistic)	0.000226		

Appendix 4.3: ARDL Model

ARDL Long Run Form and Bounds Test
Dependent Variable: D(GDP_GROWTH_RATE)
Selected Model: ARDL(4, 4, 4, 4)
Case 5: Unrestricted Constant and Unrestricted Trend
Date: 07/28/22 Time: 02:33
Sample: 2020M01 2022M03
Included observations: 23

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4558.846	1605.982	2.838666	0.1049
@TREND	19.59448	7.144774	2.742491	0.1112
GDP_GROWTH_RATE(...	-3.364365	0.681875	-4.933988	0.0387
EXCHANGE_RATE(-1)	-1188.540	419.0660	-2.836163	0.1051
INFLATION_RATE(-1)	-121.1651	54.64102	-2.217476	0.1569
INTEREST_RATE(-1)	-98.91212	37.15717	-2.661993	0.1169
D(GDP_GROWTH_RAT...	3.092390	0.742638	4.164063	0.0531
D(GDP_GROWTH_RAT...	1.961794	0.625069	3.138522	0.0883
D(GDP_GROWTH_RAT...	1.916145	0.495178	3.869608	0.0608
D(EXCHANGE_RATE)	-191.7546	114.7502	-1.671061	0.2367
D(EXCHANGE_RATE(-1))	1651.354	423.6439	3.897976	0.0600
D(EXCHANGE_RATE(-2))	295.3169	128.8443	2.292046	0.1490
D(EXCHANGE_RATE(-3))	124.2176	121.9015	1.019000	0.4154
D(INFLATION_RATE)	3.549764	16.31244	0.217611	0.8479
D(INFLATION_RATE(-1))	65.08743	26.77107	2.431260	0.1356
D(INFLATION_RATE(-2))	35.84874	12.75262	2.811089	0.1067
D(INFLATION_RATE(-3))	-12.78211	4.945805	-2.584435	0.1228
D(INTEREST_RATE)	7.865676	3.962015	1.985272	0.1855
D(INTEREST_RATE(-1))	98.87386	30.45945	3.246081	0.0832
D(INTEREST_RATE(-2))	63.36987	18.51560	3.422513	0.0758
D(INTEREST_RATE(-3))	19.76175	6.079267	3.250680	0.0830

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXCHANGE_RATE	-353.2730	70.96535	-4.978106	0.0381
INFLATION_RATE	-36.01426	10.60682	-3.395389	0.0769
INTEREST_RATE	-29.39994	6.723018	-4.373026	0.0485

EC = GDP_GROWTH_RATE - (-353.2730*EXCHANGE_RATE -36.0143
*INFLATION_RATE -29.3999*INTEREST_RATE)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	10.15996	10%	3.47	4.45
k	3	5%	4.01	5.07
		2.5%	4.52	5.62
		1%	5.17	6.36
Actual Sample Size	23	Finite Sample: n=35		
		10%	3.8	4.888
		5%	4.568	5.795
		1%	6.38	7.73
		Finite Sample: n=30		
		10%	3.868	4.965
		5%	4.683	5.98
		1%	6.643	8.313

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-4.933988	10%	-3.13	-3.84
		5%	-3.41	-4.16
		2.5%	-3.65	-4.42
		1%	-3.96	-4.73

Appendix 4.4.1 Multicollinearity

Dependent Variable: GDP_GROWTH_RATE
Method: Least Squares
Date: 07/28/22 Time: 02:40
Sample: 2020M01 2022M03
Included observations: 27

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	121.5062	148.3984	0.818784	0.4213
EXCHANGE_RATE	-28.82237	35.71530	-0.807003	0.4279
INTEREST_RATE	1.500473	1.364996	1.099251	0.2830
INFLATION_RATE	4.234405	3.225057	1.312971	0.2021

R-squared	0.304676	Mean dependent var	-0.044444
Adjusted R-squared	0.213982	S.D. dependent var	11.76927
S.E. of regression	10.43436	Akaike info criterion	7.664039
Sum squared resid	2504.144	Schwarz criterion	7.856015
Log likelihood	-99.46452	Hannan-Quinn criter.	7.721123
F-statistic	3.359369	Durbin-Watson stat	1.192320
Prob(F-statistic)	0.036228		

Appendix 4.4.1.1 Pairwise correlation

	GDP_GRO...	EXCHANGE...	INTEREST_...	INFLATION...
GDP_...	1	-0.4755825...	0.42138168...	0.40591017...
EXCH...	-0.4755825...	1	-0.6173608...	-0.4742763...
INTER...	0.42138168...	-0.6173608...	1	0.20140624...
INFLAT...	0.40591017...	-0.4742763...	0.20140624...	1

Appendix 4.4.1.2 Variance Inflation Factor (VIF)

Variance Inflation Factors
Date: 07/28/22 Time: 02:39
Sample: 2020M01 2022M03
Included observations: 27

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	22022.07	5461.230	NA
EXCHANGE_RATE	1275.583	5517.190	2.035694
INFLATION_RATE	10.40100	1.339518	1.313086
INTEREST_RATE	1.863214	2.190783	1.644497

Appendix 4.4.2 Heteroscedasticity Autocorrelation & Normality Test

Heteroscedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.403996	Prob. F(3,23)	0.7515
Obs*R-squared	1.351548	Prob. Chi-Square(3)	0.7169
Scaled explained SS	3.839592	Prob. Chi-Square(3)	0.2793

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/28/22 Time: 02:28
Sample: 2020M01 2022M03
Included observations: 27

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4163.655	3897.655	1.068246	0.2965
EXCHANGE_RATE	-977.0530	938.0556	-1.041573	0.3084
INFLATION_RATE	-46.89505	84.70552	-0.553624	0.5852
INTEREST_RATE	-12.43593	35.85136	-0.346875	0.7318

R-squared	0.050057	Mean dependent var	92.74609
Adjusted R-squared	-0.073848	S.D. dependent var	264.4652
S.E. of regression	274.0564	Akaike info criterion	14.20050
Sum squared resid	1727459.	Schwarz criterion	14.39247
Log likelihood	-187.7067	Hannan-Quinn criter.	14.25758
F-statistic	0.403996	Durbin-Watson stat	1.789812
Prob(F-statistic)	0.751507		

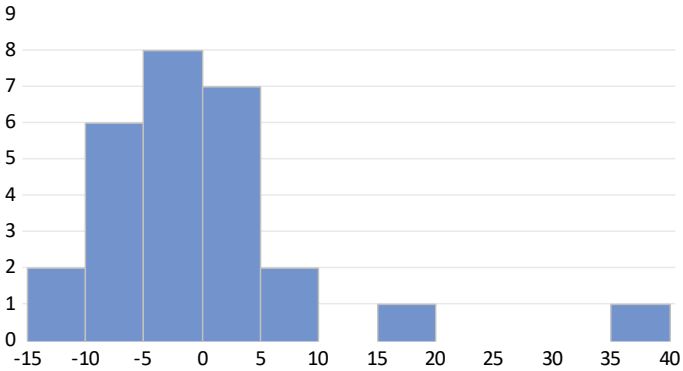
Autocorrelation Test

Dependent Variable: GDP_GROWTH_RATE
Method: Least Squares
Date: 08/01/22 Time: 12:25
Sample (adjusted): 2020M02 2022M03
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXCHANGE_RATE	-3.273370	34.60931	-0.094581	0.9255
INFLATION	6.684409	2.997442	2.230038	0.0368
INTEREST_RATE	0.633752	1.272840	0.497904	0.6237
LGDP_GROWTH_RATE	0.522989	0.178099	2.936501	0.0079
C	13.65117	144.0598	0.094760	0.9254

R-squared	0.505781	Mean dependent var	-0.165385
Adjusted R-squared	0.411644	S.D. dependent var	11.98522
S.E. of regression	9.193191	Akaike info criterion	7.445844
Sum squared resid	1774.810	Schwarz criterion	7.687786
Log likelihood	-91.79598	Hannan-Quinn criter.	7.515515
F-statistic	5.372817	Durbin-Watson stat	1.700337
Prob(F-statistic)	0.003857		

Normality Test



Series: Residuals
Sample 2020M01 2022M03
Observations 27

Mean	-9.82e-15
Median	-1.583993
Maximum	37.02245
Minimum	-11.83715
Std. Dev.	9.813931
Skewness	2.132487
Kurtosis	8.829887
Jarque-Bera	58.69979
Probability	0.000000

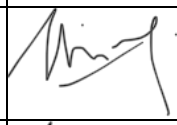
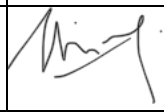
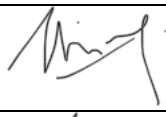
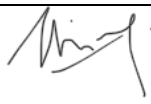
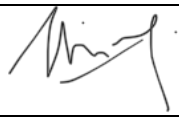
(APPENDIX C)

UNIVERSITI TUNKU ABDUL RAHMAN
FACULTY OF BUSINESS AND FINANCE
UNDERGRADUATE FINAL YEAR PROJECT [FYP]

FYP Progress Report Form

Title of FYP :	**Group No:**
Impact of COVID-19 toward Malaysia Economy	22J04

Students		**Supervisor**
Name	**ID No**	
Lau Pea Chun	18ABB04928	Dr. Tan Chai Thing
Lau Zheng Kang	18ABB05578	
Lian Khai Zhen	19ABB07078	
Li Xin Ru	18ABB06448	

Meeting No.	**Date**	**Work "milestones" / meeting report**	**Student's Signature**	**Supervisor's Signature**
1	28 Feb	Progression of Chapter 1 – Research Overview		
2	15 Mar	Progression of Chapter 1, 2 & 3		
3	15 Apr	Improvement of Chapter 1, 2 & 3		
4	30 Jun	Progression of Chapter 1, 2, 3 & 4		
5	22 Jul	Improvement of Chapter 1, 2, 3 & 4		
6	25 Aug	Discussion of overall chapters		

(APPENDIX I)

Universiti Tunku Abdul			
Form Title : **Sample of Submission Sheet for FYP/Dissertation/Thesis**			
Form Number : **FM-IAD-004**	Rev No: **0**	Effective Date: **21 June 2011**	Page No: **1 of 1**

FACULTY OF BUSINESS AND FINANCE

UNIVERSITI TUNKU ABDUL RAHMAN

Date: 15 September 2022

SUBMISSION OF FINAL YEAR PROJECT /DISSERTATION/THESIS

It is hereby certified that Lau Pea Chun (ID No: 18ABB04928) has completed this final year project/ dissertation/ thesis* entitled "Impact of COVID-19 toward Malaysia Economy" under the supervision of Dr. Tan Chai Thing from the Department of Economics, Faculty of Business & Finance.

I understand that University will upload softcopy of my final year project / dissertation/ thesis* in pdf format into UTAR Institutional Repository, which may be made accessible to UTAR community and public.

Yours truly,

(Lau Pea Chun)

*Delete whichever not applicable

(APPENDIX I)

Universiti Tunku Abdul			
Form Title : **Sample of Submission Sheet for FYP/Dissertation/Thesis**			
Form Number : **FM-IAD-004**	Rev No: **0**	Effective Date: **21 June 2011**	Page No: **1 of 1**

FACULTY OF BUSINESS AND FINANCE

UNIVERSITI TUNKU ABDUL RAHMAN

Date: 15 September 2022

SUBMISSION OF FINAL YEAR PROJECT /DISSERTATION/THESIS

It is hereby certified that Lau Zheng Kang (ID No: 18ABB05578) has completed this final year project/ dissertation/ thesis* entitled "Impact of COVID-19 toward Malaysia Economy" under the supervision of Dr. Tan Chai Thing from the Department of Economics, Faculty of Business & Finance.

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(Lau Zheng Kang)

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FACULTY OF BUSINESS AND FINANCE

UNIVERSITI TUNKU ABDUL RAHMAN

Date: 15 September 2022

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It is hereby certified that Li Xin Ru (ID No: 18ABB06448) has completed this final year project/ dissertation/ thesis* entitled "Impact of COVID-19 toward Malaysia Economy" under the supervision of Dr. Tan Chai Thing from the Department of Economics, Faculty of Business & Finance.

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FACULTY OF BUSINESS AND FINANCE

UNIVERSITI TUNKU ABDUL RAHMAN

Date: 15 September 2022

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FYP

by Khai Zhen Lian

Submission date: 16-Sep-2022 05:59AM (UTC+0800)
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CHAPTER 1 INTRODUCTION

1.1 Background of Study

Covid-19 has been an infectious disease caused by serious respiratory acute coronavirus syndrome. Every country has adopted strict measures in response to the outbreak. Most experts expect that the virus is mainly from person to person via a few ways like airborne transmission, faecal-oral transmission, droplets or aerosols, and surface transmission. The world is following lockdown procedures as precautionary measures, such as mandatory national lockdowns and border closures, in the hope of limiting the speed of the virus' spread while minimising the pandemic. In fact, Malaysia has taken some actions in dealing with the Covid-19 pandemic. The Prime Minister of Malaysia has implemented Movement Control Order (MCO) in March 2020 to avoid the widespread spread of the virus. The MCO played an important role in the early stage of its implementation, effectively controlling the increase in the number of pandemics (Mustaffa, 2021).

The first case of coronavirus was detected at the year-end of 2019 in Wuhan City of China. It was then spread rapidly around the world in the first quarter of 2020 and caused it to become a global issue of the world. According to the latest news, only vaccines have been invented to boost the body's immune system against Covid-19, but no official cure or cure for the disease has been invented, causing great panic among citizens of the world. It has taken many lives and is taking lives. Cases of the disease are spreading exponentially around the world. On January 25, 2020, the first confirmed case in Malaysia entered through neighbouring Singapore, and all three infected persons were citizens of China (Elengoe, 2020). As of April 8, 2022, the cumulative number of new coronavirus cases in Malaysia has reached 4,307,529, including local and imported cases. The number of deaths due to the epidemic is 35,259, and the total number of recoveries is 4,113,831. On March 5 this year, the number of infections in a single day hit a record 33,406.

The effects of Covid-19 have been disastrous for the world economy. Both the private and public sectors screwed up because of this virus. Inevitably, the impact of the novel coronavirus will have major national, economic and social implications. The growing threat of the novel coronavirus is a public health crisis and has hampered the macroeconomy. Not only that, but it also cuts off the supply chain of the business, causing production and manufacturers to be hindered even more. The World Economic Outlook, revised by the International Monetary Fund (IMF) in June 2020, expects the global economy to contract sharply by 4.9% in 2020, much lower than the 2008-09 financial crisis. The Organization for Economic Co-operation and Development (OECD) has stated that the spreading of Covid-19 has caused global socioeconomic distress and global economic instability.

Table 1: Percentage change of GDP (%) from corresponding quarter of the preceding year

Percentage change of GDP (%) from corresponding quarter of the preceding year										
	2019	**2020**	2019	2019	2019	2019	2020	2020	2020	2020
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
GDP	**4.3**	**-5.6**	4.5	4.9	4.4	3.6	0.7	-17.1	-2.6	-3.4

Percentage change of GDP (%) from corresponding quarter of the preceding year							
	2021	2021	2021	2021	2021	2022	2022

		Q1	Q2	Q3	Q4	Q1	Q2
GDP	3.1	-0.5	16.1	-4.5	3.6	5.0	8.9

Sources: Department of Statistics Malaysia (DOSM)

The 2019 coronavirus (Covid-19) pandemic is the latest global risk to disrupt Malaysia's GDP growth rate. According to DOSM, since Malaysia went through the pandemic, the country's GDP index has dropped significantly from 2019 to 2020, from 4.3% to -5.6%. The sharp drop shows that Malaysia has suffered a severe economic blow during the pandemic. Table 1 shows the quarterly GDP growth rates for 2019 (before the pandemic outbreak) and 2020 (after the pandemic outbreak). From the year-end of 2019 to the first 3 months of 2020, the GDP growth rate declined markedly until it fell to a record low of -17.1% in the second quarter of 2020. This event prompted us to examine the effect of Covid-19 on Malaysia's economic performance. In this study, we will focus on examining how it affects Malaysia's GDP growth rate during the Covid-19 pandemic through economic indicators, which include inflation rate, interest rate and exchange rate.

Interest rate reflects a person's or group's rate of time preference since, in economic terms, saving is the decision to forego some present spending in favour of higher future consumption. The interest rate is crucial because a higher interest rate would encourage individuals to deposit more money in banks, which would lead to significant investments and faster GDP development. When examining the relationship between interest rates and the growth of the economy, there is no doubt that a rising in interest rates would generate investment and boost economic growth. Since the outbreak of Covid-19 in Malaysia, the interest rate has fallen sharply from 0.97% in 2019 to 0.48% in 2020 as of December, according to data from the DOSM. The interest rate then gradually increased to 0.56% in 2021. This year it has also risen to 0.63% as Malaysia's economy is in a recovery phase.

Inflation is the long-term reduction in the relative buying power of a currency. Quantitative estimation of the level at which the loss of purchasing power occurs may be obtained from the rise in the average market price of a selected range of products and services over time in a given economy. The increase in pricing, commonly expressed as a percentage, effectively means that a money unit now costs less than it did previously. The demand-pull inflation happened during the Covid-19 pandemic as the demand was heavily exceeding the supply of housing goods and infectious disease prevention goods. This also raised the inflation rate from –1.14% in 2020 to 2.48% in 2021 and predicted it will continue to increase in 2022 and influence the GDP.

The price of a nation's currencies is referred to as the exchange rate. Thus, there are two parts to the exchange rate: home currency and foreign currency, which could be expressed either directly or indirectly. The foreign currency rate greatly impacts a country's level of business operations. For instance, the currency rate for Malaysia in January 2020 was RM4.08 to 1 USD, but by July 2020 it had significantly dropped to RM4.20 to 1 USD. When exchange rates are weaker will lead to cost-push inflation since the cost of imported raw commodities is increasing. Practically each industry would be affected by this situation, however, due to the fact that much of the machinery and equipment in Malaysia's manufacturing industry was imported from China and Japan, this sector would be disproportionately impacted. Because more Malaysian Ringgit must be exchanged for US Dollars, a decline in the value of Malaysia's currency will result in a drop in the Malaysian

Ringgit's buying power. This suggests that when Malaysians' purchasing power drops, it leads to dropping living standards too.

The swap in the interest rate, inflation rate and exchange rate during the tough pandemic have shown the impact of the Covid-19 pandemic on the economy in Malaysia. In this study, we will examine how those factors affected Malaysia's GDP growth rate during the Covid-19 pandemic.

1.2 Problem Statement

The issue began when positive cases in Malaysia were raised from the first case on 25 January 2020 to 117 cases on 17 March 2020. The Government had put in place sector-specific Standard Operating Procedures such as strict stay-at-home bans implemented during the Movement Control Order (MCO) period to stop the virus's spread. All gatherings within Malaysia were forbidden, and educational institutions were compelled to close, including kindergartens, primary and secondary schools, colleges, and universities. All government and private buildings were closed as well, and citizens are required to wear face masks when they are going out. Travel limits were imposed nationally unless the citizens needed to buy or supply vital goods and services.

Gross domestic product (GDP) growth has a direct impact on businesses. In an economic expansion with a growing GDP, the firms or businesses can be grown aggressively. However, in a period with negative growth of GDP in a shrinking economy, businesses must cut off some spending sharply and refocus on revenue streams, markets, and strategies. Many factors affect a country's GDP. Due to the rapid increase in Covid-19 cases in Malaysia in 2020, many sectors of the country have been severely affected. People are forced to work from home due to the highly contagious nature of Covid-19. As a result, many factories and companies are unable to produce products for customers and this indirectly affects GDP. Based on the data uploaded by DOSM, Malaysia dropped in GDP growth rate in 2020 as compared with the previous year 2019.

Inflation has been impacted by the legal implementation of health-related regulatory measures. Mixed data suggests that certain companies, like hotels and entertainment venues, were able to absorb cost increases to boost demand in the face of consumer caution, while others, like hair salons, had more inelastic demand and could pass costs on to customers. Additionally, the spending patterns of families saw a significant shift during the MCO period. The poll revealed a change toward higher food product consumption, likely as a result of households' initial MCO period stockpiling and increased domestic food consumption in general. Along with limits on travel and the forced closure of some industries, there was a decline in spending for categories including transportation, dining out and lodging, as well as recreation and apparel. Even though Malaysia has been in recovery since late 2021, the inflation rate has not gotten any lower so far but on the contrary.

Theoretically, when borrowing money becomes more expensive, growth in interest rates in an economy will deter consumers and businesses from doing so. While simultaneously pushing customers and businesses to save more money because it will earn them a higher return. This should imply a decline in total economic activity, which will result in a fall in consumer spending on goods and services as well as business investment initiatives. This will result in fewer people consuming things, fewer people earning money, fewer goods being produced, and less economic growth overall (GDP will decrease). During the period of Covid-19, the interest rate will fall sharply in Malaysia's economy in 2020. A lower interest rate, theoretically, will make it less

expensive to borrow money from banks and offer lower returns on savings, which encourages greater spending and investment and boosts economic activity. Yet the GDP of Malaysia also decreased in the year which led to the awareness of the connection between the interest rate in Malaysia and the GDP growth rate.

In addition, to have an adequate fundamental physical capital stock sustained long-term growth in the economy necessitates strong commerce and foreign exchange market to enable a controlled exchange rate system and attractive trading terms. The Central Bank's goal is to affect the value of the exchange rate of its own nation's currency in a way that will advance the interests of its population, not to make a profit per se. Most parties like investors and traders need to be able to execute business or investment operations easily. However, misalignment of the currency rate frequently hinders economic expansion. Exchange rate discrepancy in developing nations frequently manifests as overvaluation, which harms tradeable products by decreasing manufacturers' actual pricing. During the MCO period, citizens and foreigners are not allowed to enter and exit Malaysia. This will directly affect the exchange rate in the tourist sector as there is inactive demand and supply in the tourist market. In developing and developed countries, the higher exchange rate is expected to have a higher GDP value. However, during this Covid-19 pandemic, there are so many changes happening in the Malaysian economy, which makes us interested to study the link between the exchange rate and GDP during the Covid-19 period.

Currently, the Covid-19 outbreak in Malaysia has reached a Pandemic period. However, most people did not realise the effects of Covid-19 on economic growth in Malaysia. Thus, this research will focus on studying how the inflation rate, interest rate, and exchange rate affect GDP during the Covid-19 pandemic and their relationship.

1.3 Research Questions

- How did the exchange rate affect the GDP growth rate of Malaysia during the Covid-19 pandemic?
- How did interest rates affect the GDP growth rate of Malaysia during the Covid-19 pandemic?
- How did the inflation rate affect the GDP growth rate of Malaysia during the Covid-19 pandemic?

1.4 Research Objectives

The research objectives will be distributed into general and specific objectives.

1.4.1 General Objectives

The general objective of this study is to examine the economic indicators that affect the economic performance in Malaysia during the Covid-19 pandemic.

1.4.2 Specific Objective

The objectives of this study are:

- To examine the relationship between exchange rate and GDP growth rate during the Covid-19 pandemic.

- To examine the relationship between interest rate and GDP growth rate during the Covid-19 pandemic.
- To examine the relationship between the inflation rate and GDP growth rate during the Covid-19 pandemic.

1.5 Significance of the Study

The study will be able to assist the policymakers to have a clear mind and understanding while implementing the appropriate policies or decision-making in the improvement of the country's economic growth during the coronavirus pandemic. Covid-19 has caused various kinds of inconveniences to the country, especially in economic growth. If our country faced an issue similar to the situation of the Covid-19 pandemic in future, it may be more rational to have quick actions and know the steps continuously by going through this study since this research will go through the relationship between the variables such as exchange rate, interest rate, inflation rate during Covid-19 pandemic. It may help the government of Malaysia to cope with the unpredictable risk by discovering some initiative ways to minimize the risk in future by looking at this study on the significant impact of the independent variables on the GDP growth rate.

Besides, this study is important for investors to have a clear understanding of the relationship between the Malaysian economy with the exchange rate, interest rate, and inflation rate. The investors will know which of the independent variables is significant to the Malaysian economy and how significant the impact of variables will assist them in predicting stock prices' movements properly. Thus, the investors can respond to those impacts to ensure their investment return will not suffer too many losses and can minimize the risks by having good management of their portfolio properly.

1.6 Conclusion

In conclusion, Covid-19 has brought a massive effect on the country's growth all over the world. As in Malaysia, GDP severely went down as some economic indicators have been severely affected such as the exchange rate, inflation rate and interest rate. Thus, this study will examine the relationship between the exchange rate, inflation rate, interest rate and GDP growth rate of Malaysia during the Covid-19 pandemic. Thus, this research also aims to assist policymakers and investors in having better decision making which will be able to minimize the loss if there are similar issues in future.

CHAPTER 2: LITERATURE REVIEW

2.1 Relevant Theory of Study

Purchasing Power Parity (PPP)

The Swedish professor Gustav Cassel developed the purchasing power parity hypothesis. This idea states that the relative purchasing power of two countries' respective currencies determines the exchange rate between them. In order for a unit of currency from one nation to have the same purchasing power in another, the purchasing power parity (PPP) hypothesis states that the nominal exchange rate between two currencies should match the ratio of the aggregate price levels between the two countries. A country's economic performance can be measured by identifying the standard of living of its citizens. David Ricardo believes that it is more accurate to use PPP to compare the standard of living between the two countries. However, to do a comparison of the standard of living for the different countries by using the current exchange rate might affect the accuracy of the result.

From an economic perspective, purchasing power parity is an equivalency coefficient between currencies derived according to differing price levels of countries. This notional exchange rate may vary significantly in order to allow for a fair comparison of the gross domestic product of countries. According to this theory, people are willing to purchase foreign currency since it can be used to buy products and services within the nation. The national currency, on the other hand, has purchasing power for the commodities and services provided by the nation. Therefore, the exchange rate between the two countries depends on the ratio of the purchasing power of the two currencies in the two countries.

Keynesian Economic Theory

Keynesian theory was proposed by John Maynard Keynes during the 1930s. The Keynesian belief is that intervention of the government will cause the economy to stabilize. The aggregate demand (AD) and aggregate supply (AS) curves are the foundation of Keynesian models. Since the short-run AS curves in this model slope upward, movements in the demand side of the economy have an impact on both price and output.

Mamo (2012) asserts that AD and AS produce an adjustment route. The relationship between inflation and economic growth first appears to be positive, but as the adjustment route continues, it finally shifts to negative. Due to temporal irregularities, there was a positive link between inflation and economic growth at first. Prices don't have the strongest short-term impact on real output; instead, fluctuations in aggregate demand, whether predictable or unanticipated do. The majority of producers think that just their product has increased in price while business as usual is being conducted by other producers. The overall cost has actually increased. As a result, producers keep producing more and more. Additionally, Keynesian economic activity models incorporate the multiplier effect, which multiplies changes in the output by a certain amount. Most producers assume that only their product has increased in price while all other manufacturers are maintaining the same price level. In actuality, the cost has gone up overall. As a result, producers keep increasing their output. The multiplier effect, which states that a change in production is a multiple of an increase or decrease in spending that generates the change, is another feature of Keynesian models of economic activity. A $1 increase in government spending will lead to a more than $1 rise in output if the fiscal multiplier is larger than 1.

Monetary policy theory

To ensure that the supply or amount of money available at any given time is under control, the government typically uses monetary policy as one of its main tools for intervention in the overall economy. There are various techniques or tools for achieving this, but the main one that is favoured is adjusting the interest rates, exchange rates, inflation rates, and foreign reserves. (The Investopedia team, 2022). The demand for and supply of money is managed by the federal government through central bank processes via monetary policy. The possibility for industry and company players to borrow money will improve, for instance, when the interest rate is reduced since borrowing will likewise be less expensive. (Tahajuddin, Sulaiman, 2021).

2.2 Empirical Review

There is limited empirical research that examines the connection between the level of the exchange rate, interest rate, inflation rate and economic growth. The empirical review will be divided into 3 parts; Exchange Rate and GDP Growth Rate, Interest Rate and GDP Growth Rate, and Inflation Rate and GDP Growth Rate.

2.2.1 Exchange Rate and GDP Growth Rate

An argument has existed in a discussion of a positive or negative relationship between exchange rate and GDP growth. In general, the conventional view holds that a rising exchange rate has a positive effect on economic growth, while a structuralist perspective holds that a rise in the exchange rate leads to economic contraction(Karahan,2020). According to Ayodele (2014) and Adeniran et al. (2014), both research was conducted in Nigeria by using the same method which is OLS by looking at the link between the exchange rate and GDP growth rate. However, the results from both research are opposite. Ayodele (2014) discovered that there is a negative relationship and Adeniran et al. (2014) is a positive relationship significantly between exchange rate and GDP growth.

The findings from Ahma et al. (2013) stated that the depreciation of a country's currency will lead to cheaper prices in export and hence the increase in demand for exports will result in an upward trend of GDP growth. By having research in various countries, the same results agreed that the depreciation of the exchange rate will boost the countries to explore more output (Lubis et al., 2017: Madmarov, 2018; Glüzmann et al., 2012). However, Attah-Obeng & Inu (2013) have different results and strongly conclude that the rising exchange rate will result in the positive growth of GDP in the short run by having studied in Ghana. Based on Jakob (2015), has assumed that a stable condition of a strong country currency will bring more confidence to investors to have their business operation in the country and hence the economic output can be increased.

Based on research carried out by Al-Bayati et al. (2022) which used the ARDL estimation of results indicated that an upward trend of the official exchange rate will result in a declining trend of GDP in the case of Iraq. Since Al-Bayati et al. (2022) covered the sample period from 1988 to 2020, it has reflected the economic situation of Iraq before the Covid-19 pandemic until the outbreak of the Covid-19 period. The findings disclose that, during the Covid-19 pandemic period, it has

caused disruptions in economic activities, thus the government of Iraq has taken action to devalue the country's currency.

Throughout the Johansen test, Yusoff & Febrina (2014) stated that there is a short-run and long-run relationship between exchange rate and GDP growth in the case of Indonesia throughout the Johansen cointegration test. Karahan (2020) has discovered that, in Turkey, there is a long-run relationship between the exchange rate and GDP growth rate. The exchange rate affects the GDP growth rate negatively in Turkey. Besides that, Madmarov (2018) and Hussain et al. (2019) have discovered that the devaluation of a country's exchange rate will have a short-run and long-run positive impact significantly towards GDP growth in their research of Kyrgyz and Pakistan respectively.

2.2.2 Interest Rate and GDP Growth Rate

There is limited research that has been conducted to determine the interest rate and GDP growth rate. According to Matarr & Momodou (2021) research, the link between the GDP growth and the interest rate in the short-run and long-run is examined by, Vector Error Correction Model (VECM) in the Gambia. The result shows that the key inference can be made while interest rates do not directly correlate with economic development in the short run, yet they do negatively affect the performance of the Gambia economy over the long run.

According to Davcev et al. (2018), the research is conducted within Bulgaria, Romania, and Fyrom to examine the relationship between interest rates and GDP growth rate by the Johansen Test. The result indicates that in Bulgaria, the relationship between interest rates and GDP is inverse. Romania's interest rates are negatively correlated with GDP, but at far higher levels than in Bulgaria. Contrarily, Fyrom has a negative relationship between interest rates and GDP.

The Southern African Customs Union (SACU) was the subject of an empirical research study by Taderera et al. (2021), which concluded that policymakers should permit a high sustainable inflation rate for promoting economic growth and the interest rate can be used as a tool for monetary policy to achieve the considered inflation rate that will have a positive impact on economic growth. Based on research conducted by Harswari et al. (2017) between the years 2006 and 2015, the interest rate has a negative substantial influence on GDP.

Moyo & Pierre (2018) investigated the fluctuation in interest rate effect on the SADC nation's performance by using ARDL bound tests. The findings demonstrated that interest rate liberalisation has positive results on the performance of the economies of SADC nations. Economic growth slows down as a result of lower interest rates used to stimulate it. Additionally, using partial least squares (PLS) to test the hypothesis, Semuel & Nurina (2014) research examined the impact of interest rates on Indonesia's GDP. Following the generation of the results, the researchers discovered that the relationship between interest rates and GDP is significantly negative.

2.2.3 Inflation Rate and GDP Growth Rate

Referring to Hoang & Tien (2022), it's a case in Vietnam state that results of OLS estimation show that there is an inverse relationship between inflation and GDP growth by having a sample period

of around 40 years. An inflation rate larger than 6% will negatively impact economic growth. On the other hand, an inflation rate smaller than 6% will boost the economy. By looking at the research of Nurul et al. (2017) in Malaysia using the same method to carry out the test and get the results there is an insignificantly negative correlation between inflation and GDP growth. Besides that,

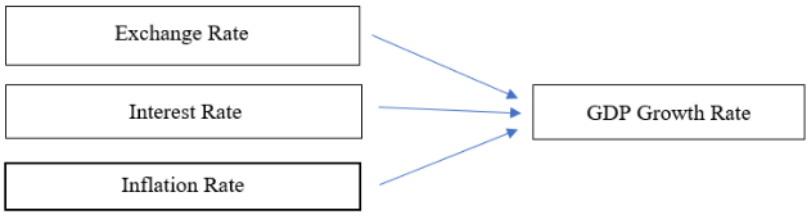
Based on a research study by Nurul et al. (2017) in Malaysia, the finding from the OLS method stated that there is a negative correlation between inflation and GDP growth but insignificantly. Besides that, Islam and Sahajalal (2019) also discovered that Bangladesh's GDP growth is negatively impacted by the country's high inflation rate. However, the findings from Adu-Gyamfi et al. (2020) that using the same model have a different result in the case study of 9 West Africa Countries. It indicated that there is an insignificant effect of inflation on GDP via the fixed effect model but has a negative effect significantly on GDP using the OLS method.

According to the research study of Rouksar-Dussoyea et al. (2017) and Najafi Bousari et al. (2022), both studies are going through a fixed-effect model and the results for both studies are negative toward GDP growth. Rouksar-Dussoyea et al. (2017), a case study of 6 European Countries, shows inflation has an insignificant impact on GDP growth. However, Najafi Bousari et al. (2022) have found out that inflation has brought a significant effect on the GDP growth of Iran.

Throughout ARDL estimation, there is a short-run and long-run relationship between inflation and GDP growth in the case study of Pakistan. By having research from January 1991 to May 2020, the researchers also observed that inflation harms GDP growth and suggest that a low inflation rate is more necessary in boosting the country growth of Pakistan, especially during that tough period of the Covid-19 pandemic (Hayat et al., 2021). Furthermore, a study of Nigeria using ARDL and VECM approaches showed a significant positive relationship between inflation rate and GDP growth in the short run and long run. (Enejoh & Tsauni, 2017).

There is an interesting finding regarding inflation's sensitivity to growth rate changes being greater than growth's sensitivity to inflation rate changes. There are significant policy implications for these findings. Contrary to the international lending agencies' policy recommendations, attempts to bring inflation to a very low level or to zero are likely to have a negative impact on economic growth. Nonetheless, accelerating economic development can overheat the economy to the point where inflation becomes unpredictable, unstable and uncertain. Thus, these economies are precariously balanced. (Mallik, 2001).

2.3 The Study's Empirical Framework



Based on the empirical studies, we proposed a framework as above, the dependent variable will be the GDP growth rate in Malaysia, while the independent variable is the exchange rate, interest rate and inflation rate. The reason for adopting this research is to determine the relationship between the exchange rate, interest rate and inflation rate with the GDP growth rate in Malaysia.

2.4 Hypothesis Testing

This research is made to investigate how the exchange rate, interest rate and inflation rate will influence the GDP growth rate during the Covid-19 pandemic. Thus, there are 3 hypotheses that were made as shown below.

Hypothesis 1:

- H_0: There is no significant relationship between the exchange rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic.
- H_1: There was a significant relationship between the exchange rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic.

The study is expected to show the exchange rate significantly affected the GDP growth rate in a negative relationship in the Malaysian economy during the Covid-19 pandemic. A strong exchange rate will result in a declining trend in economic growth as exports will be more expensive and citizens will prefer to spend more on imported goods.

Hypothesis 2:

- H_0: There is no significant relationship between interest rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic.
- H_1: There was a significant relationship between interest rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic.

It is expected to have a negative relationship between the interest rate and GDP growth rate of the Malaysian economy during the Covid-19 pandemic. It was assumed that keeping a low-interest rate would boost the economic growth of a country, especially during the Covid-19 pandemic.

Hypothesis 3:

- H_0: There is no significant relationship between the inflation rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic.
- H_1: There is a significant relationship between the inflation rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic.

It is expected to have a negative relationship between the inflation rate and GDP growth rate in the Malaysian economy during the Covid-19 pandemic. When a low inflation rate exists during a tough situation, it will also result in a high GDP growth rate in Malaysia.

Variables	Unit Measurement	Expected Relationship with GDP

Exchange Rate	Percentage changes in the exchange rate	Negative
Interest Rate	Percentage changes in the interest rate	Negative
Inflation Rate	Percentage changes in the inflation rate	Negative

2.5 Gap of Literature Review

Since the outbreak of Covid-19, most researchers have explored the studies regarding the impact of the issue on the Malaysian economy. After research, it was found that there is a huge effect of the Covid-19 pandemic on the economy of Malaysia. After reviewing many studies, we found that most of the research by the researchers did not use the performance of economic indicators as a variable to understand the effect of Covid-19 on the Malaysian economy. Therefore, the impact of Covid-19 on the economy of Malaysia will be shown in our research in the form of different economic indicators.

In addition, after research, it is found that most of the researchers' research direction is the impact of Covid-19 on the industry rather than the impact on the Malaysian economy. Therefore, at the time of completing the research, there was a lack of sufficient references to support our theories and directions.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This analysis is a strategy to review and analyse data to provide the information from the data. Throughout this research, the EViews 12 software will be used by analyzing the data. This will be able to let researchers have a better understanding of the link between the indicators.

3.2 Data Collection Method

In the research, time series analysis will be used and applied to investigate the relationships of independent variables toward the economic growth of Malaysia by applying secondary data. The data set and information that is used in the study will be collected from journal articles and online databases such as DOSM and Bank Negara Malaysia (BNM). This study will focus on the Covid-19 period. Therefore, the data collected would be from Jan 2020 until March 2022 on a monthly basis, the total observation will be 27. After that, the data will be then transmitted to EViews 12 software for data investigation. To assure the accuracy of the data, recent data is collected by referring to the source of data which is from DOSM and BNM.

3.3 Variables Measurement

Variables	Unit of measurement	Data sources	Data period
Exchange Rate	Changes in percentage (Δ%)	BNM	Jan 2020- Mar 2022

Interest Rate	Changes in percentage (Δ%)	BNM	Jan 2020- Mar 2022
Inflation Rate	$\frac{CPI_{current} - CPI_{previous}}{CPI_{previous}} \times 100$	DOSM	Jan 2020- Mar 2022
GDP Growth rate	Changes in percentage (Δ%)	DOSM	Jan 2020- Mar 2022

Exchange Rate:

It is a measurement that is used to estimate the changes of the exchange rate in a country. It is a determinant of a country's economic performance. A higher exchange rate is expected to worsen a country's trade balance, whereas a lower exchange rate will improve it.

Interest rate:

It is a measurement of the average lending rate. The cost of borrowing and rate of return for the lender are both indicated by the interest rate. Interest rates can also represent the number of earnings of a bank. When interest rates are high, it means more cost of borrowing money; when interest rates are low, lesser cost of borrowing money.

Inflation Rate:

It is calculated based on the CPI in the current period over the CPI in the base period in terms of percentage rate (Raphael Zeder, 2017). In simple form, it is a measurement to estimate the living costs of citizens. A high inflation rate indicates that the price of commodities has been raised at that moment.

GDP Growth Rate:

It reflected the economic growth of a country by comparing the latest GDP with the previous GDP in percentage rate. The percentage of growth rate can be in positive and negative value by the observation of whether there is a growing or declining trend in GDP. It will be used to measure how fast a country is growing in its economy which is affected by various kinds of variables (Fern et al., 2022).

3.4 Multiple Regression Model

This model assists to analyse the relationship between each dependent variable with several independent variables. It was applied to forecast the value of the single dependent variable by having values on the independent variables.

$$Y=1X1-2X2+3X3+\mu$$

Y = GDP Growth Rate
X_1 = Exchange Rate
X_2 = Interest Rate
X_3 = Inflation Rate
μ = error term

3.5 Data Analysis Techniques

3.5.1 Unit Root Test

Unit root test is a stochastic trend in time series. The variation is hardly predictable. Macroeconomic variables such as GDP, exchange rate, interest rate and the inflation rate will show an upward or downward movement strongly over time without the tendency to return to a fixed mean. So, they are non-stationary. In econometrics, we will apply the unit root test to check the stationary status of the time series variable. There are two widely used stationary test methods which are Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP).

3.5.1.1 Augmented Dickey-Fuller (ADF) Test

One of the common methods to test the unit root. It is the expansion of the Dickey-Fuller test by adding the lag inside the model to minimize the autocorrelation problem.

$$\Delta yt = yt-1 + i=1 pi \Delta yt-i + t$$

The augmentation (p>0) will not have the effect of the asymptotic distribution of the test statistic.

The hypothesis testing:

H_0 = series contains a unit root H_1 = series is stationary

3.5.1.2 Phillips-Perron (PP) Test

Phillips-Perron tests an alternative model to test for unit roots. This test is likely to be the ADF test, but to account for autocorrelated residuals, the automated correction was added to the Dickey-Fuller technique. PP test This test will give the same conclusion as Augmented Dickey-Fuller. The hypothesis testing is the same as the augmented Dickey-Fuller test.

3.5.2 Autoregressive Distributed Lag (ARDL) Model

ARDL bound test is used to observe the long-run relationship existing in the series (Pesaran et al., 2001). Accordingly, the ARDL is used to find the integration, which was also a suitable fit with tiny sample sizes of data. Recently, the ARDL approach has grown in popularity in some empirical studies to look forward to the economic growth in Malaysia such as Gamal al et. (2021), Majid (2008), and Ali et al (2022). Those empirical studies use the ARDL model in order to look forward long run cointegration of the variables. Therefore this study was also using the ARDL model to find out the long-run relationship between the exchange rate, inflation rate and interest rate toward Malaysia's GDP growth rate. Other than that, this study was using only 27 observation data. Therefore, the ARDL model can be used in this research as it is a good fit for small sample sizes of data. Besides that, the lag selection criteria for using the ARDL bound test were determined in this study using AIC, which suggests that the model produces superior results overall. The lag selection criteria for using the ARDL bound test are all determined using the AIC, which suggests that the model performs better.

The ARDL model is appropriate for time series with mixed order of integration and non-stationary time series. The model needs a long enough lag to reflect the typical data creation process for a given modelling framework. When I (0), I (1), or mutual cointegration are used as the model's inputs, ARDL fits the independent variable. However, it is impossible if I (2) is present in any variables. This will be one of the ARDL model's presumptions because the model will not operate when the variables are stationary at I(2).

To determine the relationship between dependent and independent, the following model was constructed as

$GDP_t = ER + Int + Inf + Et$ – Equation1

Where GDP represents the GDP growth rate in Malaysia, while t represents the period from Jan2020 until March 2022. ER represents exchange rate, Int represents interest rate and Inf represents inflation. Et represents the error term. Equation 1 can be written in ARDL form as follows:

$$\Delta GDP_t = \Delta GDP_{t-k} + \Delta Int_{t-k} + \Delta Inf_{t-k} + \lambda GDP_{t-1} + \lambda Int_{t-1} + \lambda Inf_{t-1} + \in_t$$ – equation 2

Where Δ shows the first different, $\in_t$ show the white noise. The Akaike information criterion (AIC) is applied in this research to determine the lag length.

3.5.3 Stability test for CUSUM & CUSUMSQ

The short-run and long-run coefficients suggested by Brown et al. (1975) owing to the occurrence of structural changes in all variables due to single or many structural breakdowns were examined using cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests. These tests, according to earlier research (Pesaran & Shin 1995; Pesaran et al. 2001), show the ARDL model's high level of fitness. The residual of ECM is plotted using these tests. The results imply that the ARDL model's coefficients are stable if the statistical data in the plot falls below critical bounds at a 5% significant value.

3.6 Diagnostic Checking

3.6.1 Multicollinearity

The variables that are highly correlated to each other in the econometrics model will cause the problem of multicollinearity. The high correlation will hinder the independent variable by showing its effect and relationship on the dependent variables. Multicollinearity problems cause the statistical inference to become inaccurate. Therefore, the multicollinearity increases in the R^2 of the independent variables. Thus, the parameter with large variance indicates that the standard error is high, and the smaller test statistic value will be obtained, the confidence interval obtained will be larger, and there will be an increasing probability that the false hypothesis will not be rejected.

The method to detect multicollinearity problems is when obtaining a high R^2 was associated with some significant t-ratios, it meant that significance was detected in general statistics, but not in individual statistics. Besides that, pairwise correlation. Its range is from -1 to 1, where -1 is a negative perfect correlation and 1 is a positive strong correlation. Furthermore, to detect multicollinearity problems by using VIF and TOL.

$$VIF=1(1-RX1X22)\ TOLj=1VIFj=1-rX2X32$$

VIF

VIF value	Interpretation

VIF=1	No multicollinearity found
1<VIF<10	No series multicollinearity found
VIF=∞	Perfectly multicollinearity found
VIF>10	Serious multicollinearity found

TOL

TOL value	Interpretation
TOL=1	No multicollinearity
TOL close to 0	Serious multicollinearity
TOL close to 1	No serious multicollinearity

VIF and TOL which equal to 1 will show that there is no multicollinearity while there will exist a high multicollinearity problem in the model when VIF value is greater than 10 or TOL value is closer to 0.

3.6.2 Heteroscedasticity

Heteroscedasticity used to describe the situation of the error variance and this caused by the outliers present in the data. Heteroscedasticity may significantly affect the result of the regression model, especially if the data set is small.

Breusch-Pagan test is used to detect the heteroscedasticity in linear regression model

The hypothesis is as following:

H0: 2 = 3 = 4 = 0 (There is homoscedasticity.)

H1 : At least one $\alpha \neq 0$. (There is heteroscedasticity.)

If Breusch-Pagan test's p-value is less than alpha value, H0 is rejected. Hence, there is sufficient evidence to conclude there is existence of heteroscedasticity.

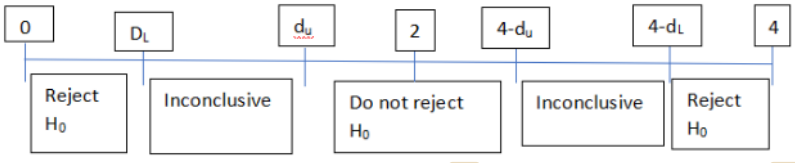
3.6.3 Autocorrelation

When the error terms are correlated, it will show that they are dependent with each other in previous data. By using Durbin Watson d Test is estimated residual in the regression analysis.

The hypothesis is as below:

H0 : = 0 (There is no autocorrelation)

H1 : ≠ 0 (There is autocorrelation)



There is autocorrelation if d falls below d_L or larger than 4-d_L. When d is between d_u and 4-d_u, do not reject H_0. Other than that, the result will be inconclusive.

3.6.4 Normality Test

To check whether the error term has fulfilled the normality assumption, Jarque-Bera (JB) test is used to measure the error term. The JB test can also measure the skewness, check for symmetry and kurtosis, and calculate the level of normal distribution. The Jarque-Bera (JB) test's formula is as follows:

$$JB = nS26 + (K-3)224$$

The hypothesis testing is as below:

H0: The error terms are normally distributed.

H1: The error terms are not normally distributed.

By using the p-value approach to test the normality assumption, we will reject H_0 when the p-value is smaller than the significant value. Therefore, this will show that the error terms are not normally distributed.

3.7 Conclusion

To sum up everything in this chapter, it describes the data collection method, sources of data, variable measurement, and the methodologies that are used in this research. All the empirical results will apply to Eviews 12 to generate in the next chapter.

Chapter 4: Data Analysis

4.1 Descriptive Analysis

Table 4.1: Result of Descriptive Statistics.

	GDP	Exchange Rate	Interest Rate	Inflation Rate
Mean	-0.0444	4.1755	-1.0873	0.1012
Median	-2.1	4.1662	0.8230	0.2402
Maximum	39.7	4.3553	1.5342	1.2438
Minimum	-28.8	4.0387	-6.0586	-2.7295
Standard deviation	11.769	0.0817	1.9225	0.7271
Skewness	0.9278	0.4153	-0.9022	-2.2938
Kurtosis	7.2464	2.8525	3.3040	10.0375
Observations	27	27	27	27

Based on table 4.1, the mean value of GDP is -0.04%, the median value is -2.1% and the standard deviation is 11.77%. Maximum and minimum values for GDP are 39.7% and -28.8%. Furthermore, the average means of the exchange rate is 4.18% with a median value of 4.17%. The values in the

dataset deviate from the relative mean by 0.08% for the variable exchange rate. Furthermore, the largest value of the exchange rate is 4.36% while the lowest value of the exchange rate is 4.04%.

Moreover, the mean value of the interest rate is -1.087% and the median is -0.82%. Interest rates included a minimum value of -6.06% and a maximum value of 1.53%. The interest rate shows a standard deviation of 1.92%. In addition, the average value of the inflation rate is 0.1% and with a median value of 0.24%. Maximum and minimum inflation rates at 1.24% and -2.73%, respectively. For the inflation rate, the values in the dataset deviate at 0.73%.

4.2 Unit Root Test

Table 4.2: Results of ADF & PP Test

Variables	Test-Statistic Value			
	Intercept Without Trend		Intercept With Trend	
	Panel A: Level I(0)			
	ADF Test	PP Test	ADF Test	PP Test
GDP	-3.6710**	-2.6035	-4.6176***	-2.7692
Inflation	-3.2661**	-3.1447**	-3.4581*	-3.2642*
Exchange	-2.0034	-2.3210	-2.1362	-2.4778
Interest	-0.9744	-3.1906**	-2.1198	-5.2691***
	Panel B: First Difference I(1)			
GDP	-5.2946***	-5.1042***	-5.1537***	-4.5490***
Inflation	-5.1313***	-9.8543***	-5.0191***	-9.0943***
Exchange	-5.4812***	-5.48the 91***	-5.3357***	-5.3705***
Interest	-6.4688***	-11.0130***	-6.2627***	-10.4556***

Source: Computation Result from EViews.

Notes: *,** and *** represent the rejection of unit root at significance levels of 10%, 5% and 1% respectively.

Based on the result of the ADF unit root test those variables shown in the table which are GDP, inflation rate, exchange rate and interest rate at the level form and 1st difference for with trend and without trend. At the level from intercept without trend, interest rate and exchange rate are showing non-stationary since the null hypothesis cannot be rejected due to the fact that both p-values are greater than significance levels 1%, 5% and 10%. At the level form intercept with the trend, interest rate and exchange rate also show non-stationary. The null hypothesis cannot be rejected due to the p-value being greater than significance levels 1%, 5% and 10%. However, the level of GDP and inflation rate are stationary in both intercept with the trend and without trend. The p-value of GDP and inflation rate at the level of intercept without trend is less than the significance level 5% and 10%, hence the null hypothesis should be rejected.

At the first difference level, GDP and inflation are also shown as stationary data, but the exchange rate and interest rate are non-stationary data. Based on the ADF test, the p-value of GDP is below significance levels of 1%, 5% and 10% and the p-value of the inflation rate is below the significance level of 10%. The null hypothesis should be rejected, GDP and the inflation rate are stationary data. Moreover, the null hypothesis cannot be rejected in the ADF test of exchange rate and interest rate. It is due to the p-value of both rates being greater than the significance level of 1%, 5% and 10%.

On the other hand, the result of the Phillips Petron (PP) test is shown in the table. In level form, GDP and exchange rate are non-stationary both with the trend and without trend. It is because the p-value of GDP and exchange rate are greater than significance levels of 1%, 5% and 10%, hence the null hypothesis cannot be rejected. Besides, based on the PP test result in inflation rate and interest rate are stationary in both intercepts with a trend and without a trend. It is due to the p-value of both rates being less than the significance level of 5% and 10%. According to the PP test, at the first difference form, all the variables are stationary in both intercepts with the trend and without the trend. Since the p-value for the variables is lesser than significance levels 1%, 5% and 10%. Hence, the result in table 4.2 shows that all variables, GDP, inflation, interest rate and exchange rate are stationary in order of integration of I(1) as all p values are lower than significant levels of 1%, 5% and 10%.

4.3 Autoregressive Distributed Lag (ARDL) Model

After determining that the variables the exchange rate, interest rate, inflation rate and GDP growth rate are stationary at I (1), we employ the Autoregressive Distributed Lag(ARDL) Model in order to investigate the long-run relationship between the variables.

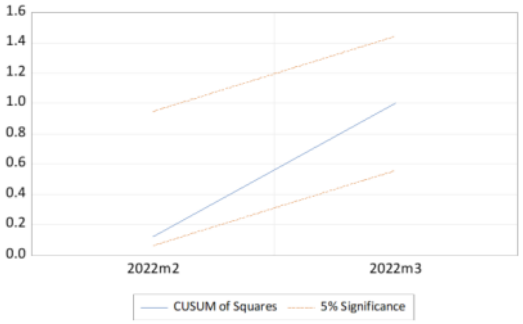
Table 4.3.1: Result of ARDL Long Run Form & Bound Test

F-Bounds Test		Null Hypothesis: No Levels Relationship		
Test Statistic	**Value**	**Significance Level**	**I(0)**	**I(1)**
		Asymptotic: n = 1000		
F-Statistic	10.15996	10%	3.47	4.45
k	3	5%	4.01	5.07
		2.5%	4.52	5.62
		1%	5.17	6.36

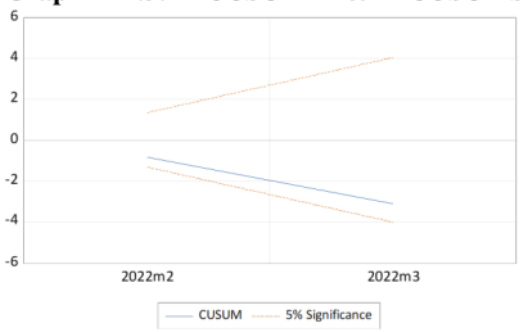
Table 4.3.2: ARDL Model (4,4,4,4)

Level Equation		
Variable	**Coefficient**	**Probability**
Exchange Rate	-353.2730	0.0381
Inflation Rate	-36.01426	0.0769
Interest Rate	-29.39994	0.0485
Residual Diagnostic Test Result		
CUSUM	Stable	

CUSUMSQ	Stable



Graph 4.3: CUSUM & CUSUMSQ



Based on table 4.3.1, it showed that the existence of a long run relationship between independent variables and dependent variables since the t-statistic value of 10.16 is greater than significant levels of 1%, 5% and 10%.

According to table 4.3.2, the coefficient of the exchange rate, inflation rate and interest rate are -353.27, -36.01 and -29.40 respectively. It indicates that exchange rate, interest rate (Taderera et al., 2021) and inflation rate (Hoang & Tien, 2022) have a negative relationship with GDP. Moreover, the exchange rate is significant in the long run relationship between GDP, since the P-value is 0.0381, which is less than the significance level 5%. Besides, the p-value for inflation rate is 0.0769 lesser than significance level 10%, it shows that inflation rate is significant to GDP in long run. Interest rate shows long run significance to the GDP, since the p-value 0.0485 is lesser than significance level 5%.

Based on the graph 4.3, the results of CUSUM and CUSUMSQ show that both are in stable condition. The blue lines which represent CUSUM and CUSUM of Squares are in between the significance level of 5% over the time to confirm the stability and good fitness of the ARDL model.

4.4 Diagnostic checking

Diagnostic testing is crucial to find any potential errors in our data collection in order to guarantee that the findings are correct and trustworthy. This section included multicollinearity, heteroscedasticity, autocorrelation, and normality tests.

4.4.1 Multicollinearity

In order to test the multicollinearity, pairwise correlation, VIF and TOL will be the main indicator to detect the problem.

4.4.1.1 Pairwise correlation

Table 4.4.1.1: Result of Pairwise Correlation

	GDP	Exchange Rate	Interest Rate	Inflation Rate
GDP	1	-0.4756	0.4214	0.4059
Exchange Rate	-0.4756	1	-0.6174	-0.4743
Interest Rate	0.4214	-0.6174	1	0.2014
Inflation Rate	0.4059	-0.4743	0.2014	1

According to the table above there is not strong positive correlation or strong negative correlation among the variables as the value is not close to 1 or -1. Hence, there is no significant multicollinearity between variables during the Covid-19 period.

4.4.1.2 Variance Inflation Factor (VIF) and Tolerance (TOL)

Table 4.4.1.2: Result of Variance Inflation Factor (VIF) and Tolerance (TOL)

Independent variable	VIF	TOL=1/VIF
C	NA	
Exchange Rate	2.0357	0.4912
Inflation Rate	1.3131	0.7616
Interest Rate	1.6445	0.6081

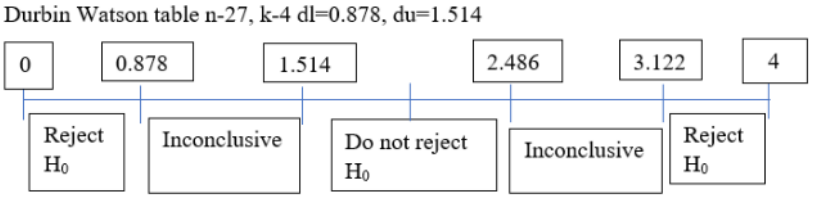
According to the table above each independent variable by referring to all of the VIF value are in the middle of 1 and 10, therefore it shows that there is no severe multicollinearity found while referring to TOL value, all of the value is closer to 1 which also indicate did not exhibit serious multicollinearity.

4.4.2 Heteroscedasticity, Autocorrelation & Normality Test

Table 4.4.2: Results of Heteroscedasticity, Autocorrelation & Normality Test

Diagnostics Tests	P-value / T-stat value	Outcome
Breusch-Pagan-Godfrey	0.7169 (p-value)	Problem of heteroscedasticity - No
Durbin-Watson	1.7003 (t-statistic value)	Problem of autocorrelation - No
Jarque-Bera Test	0.0000 (p-value)	Problem of normality - No

Based on heteroskedasticity tests, there is no heteroscedasticity in the model. Since the probability of Chi-square (0.7169) is greater than the significance level of 5% and 10%. There is enough evidence to reject the null hypothesis. Hence, the model is having homoscedasticity that shows a good regression model.



Test statistic value = 1.7003

To define the autocorrelation problem in the model, Durbin Watson test is used in this research. In this study, the test statistic value is 1.7003 which is in between 1.514 and 2.486 shows the result that the model is free from autocorrelation problems.

Based on the normality test, the P-value is 0, which is less than the significance level of 1%, 5% and 10%. Hence, there is sufficient evidence to conclude that the error term in the model is not normally distributed.

CHAPTER 5: DISCUSSION, RECOMMENDATION & CONCLUSION

5.0 Introduction

By contrasting the results of the test with the findings of the literature review in Chapter 2, we will provide the key conclusions from our study from Chapter 4 in this chapter. To enhance the information in this research report, the study's limits, suggestions for more research, and findings will be presented.

5.1 Discussion of major findings

Exchange rate

According to the test results in Chapter 4, it shows that there is a relationship between the exchange rate and the GDP growth rate. It brings out the result that explains the increase in exchange rate by 1%, the GDP growth rate will drop by 353.2730, ceteris paribus. The coefficient of the exchange

rate is –353.2730 indicates the relationship between these 2 variables is negative which meets our expectations in the study. The result will be the same as the research studies done by two researchers (Ayodele, 2014; Ahmad & Ali, 2013). Both kinds of research have acquired the result that the exchange rate has a significantly negative influence on the GDP growth of the sample countries being observed. According to Ayodele (2014), when the currency of a country faces depreciation, the exports will be cheaper and thus demands for exports will rise which will result in a growing trend of GDP growth of the country.

Interest rate

Besides that, the result also shows that interest rates are also significant toward the GDP growth rate. When the interest rate increases by 1 %, the GDP growth rate will decrease by 29.39994, ceteris paribus. The result of the relationship between interest rate and GDP growth rate met our expectations, which is a negative relationship, since the coefficient of the interest rates was –29.39994 . This result will be the same as the result conducted by Semuel & Nurina (2014). The result of their studies has discovered that the interest rate will have a negative relationship with GDP growth. According to the International Fisher Effect, nations with high-interest rates will also have high rates of inflation (Ersan, 2008). Additionally, inflation contributes to a rise in poverty. Significant inflation will cause a company's production expenses to tend to grow and production capabilities to decrease, resulting in a decline in product output. A decrease in production will lead to a decrease in the GDP of the country (Semuel & Nurina, 2014).

Inflation rate

Furthermore, the results obtained show that there is a significant inflation rate and GDP growth rate. While the inflation rate increases by 1 %, the GDP growth rate will decrease by 36.01426, ceteris paribus. The coefficient of the inflation rate is –36.01426, the negative sign means there exists a negative relationship toward GDP growth. The result is not only the same as our expectations but also matches with some studies conducted by some researchers (Hoang & Tian, 2022; Nurul & Azmi, 2017; Najafi Bousari et al., 2022). The results of their studies have discovered that inflation rate has a significantly negative impact towards the GDP growth rate in the countries as observed. According to Ivory Research (2019), high inflation indicates a low purchasing power of citizens. With a low purchasing power, consumption will be reduced and thus affect the GDP growth rate to decline.

5.2 Implication of the study

This study was conducted to find out the impact of the Covid-19 pandemic on Malaysia's economy. The study topic of Covid-19 in an aspect of different views has been conducted by other researchers such as the tourism sector etc. The study of the impact Covid-19 pandemic on Malaysia was less. Therefore, this study was carried out to fill the research gap in the aspect of the Covid-19 pandemic in Malaysia. Hopefully, this study will help future researchers with some information about the impact of covid-19 on Malaysia's economy. Furthermore, policymakers and investors also could have a study report for references in order to help them to make decision making to prevent uncertainty.

Besides that, allow policy-makers, such as the government and the Central Bank of Malaysia, to discover the factors that have a substantial impact on Malaysia's economic growth based on the research topic. It is abundantly obvious from Chapter 4 that Malaysia's GDP growth rate will be

significantly impacted by the exchange rate, interest rate, and inflation rates. To prepare for the next crisis, the government and policymakers may decide whether Malaysia's economy would grow or decrease in different economic conditions. Moreover, the results of this study might be used as a reference by the central bank and policymakers to adjust fiscal and monetary policies such as adjusting the OPR rate, having the stimulus packages and so on, particularly in terms of economic development, in order to assist the recovery and reformation of the Malaysian economy if the crisis happened.

Other than that, this study may serve as inspiration for similar research in the future. Future researchers can assess what variables should be in their studies on related topics by using this study as a guide. For example, macroeconomic factors which consist of the level of the unemployment rate, price, human capital, money demand and supply and other macroeconomic indicators can be added on to find out the relationships with the GDP growth rate.

Last but not least, the individuals who refer to capitalists and stakeholders who are interested in the Malaysian economy will also find this study to be essential. This study details Malaysia's GDP growth in response to the pandemic. Foreign investors who are interested in investing in Malaysia will be able to understand the connection and significance of the chosen variables. They can use this study as a guide to get a clear understanding of how Malaysia's GDP growth rate and the variables relate in order to make accurate investment choices and determine the best time to invest.

5.3 Limitation of the Study

Based on our study, a few limitations we faced in conducting this study are to be mentioned in this topic. In this study, we have faced the limitation of fewer sample data acquired. Since Covid-19 has just occurred around 2 years in the world, we are just able to estimate around 27 sample periods of monthly data from January 2020 to March 2022 for the cases in Malaysia. Thus, although we still can get a significant result in the study of the impact of Covid-19 on the economy of Malaysia, the results of this study may not be appropriate as well to be a reference as fewer data are included. Besides that, this study only focuses on Malaysia’s economy compared to other research which conducts the study that compares developing or developed countries. In addition, the difficulty to develop theory in our study is one of the major problems that we face. We tried to find the theories that can fit our variables, but the theories we found did not fit our objective of this study.

5.4 Recommendation

Researchers would want to recommend a few adjustments if future researchers were to design this study again in the future. Most importantly, this study advises extending the time frame in order to collect involvement across the whole research process, from original conception through dissemination. It is advised that future researchers do comparisons between the pre-, during-, and post-Covid-19 pandemic periods to advance their research. This is due to the fact that the research was done when the pandemic was still active. By having the comparisons, future researchers will be able to compare data from three distinct time periods while also increasing the sample size and time window. Besides that, future researchers may also recommend using other indicators or variables to carry out the study. This is because there is also another indicator or variable that will

bring impact the economy of the country. For example, GDP may also be impacted by non-economic or political factors. Therefore, future researchers will be able to make a comparison between the research. Additionally, to evaluate and adjust for measurement mistakes and improve the accuracy of the data, researchers can also include several indicators in the study.

5.5 Conclusion

In short, Covid-19 has brought many effects on the whole world including Malaysia. The exchange rate, interest rate and inflation rate have also been impacted while the effects of variables represented the result of the GDP growth rate of Malaysia during the Covid-19 pandemic.

In this study, we have gone through the discussion about the relationship between the exchange rate, interest rate, inflation rate and GDP growth rate of Malaysia during the Covid-19 pandemic which covers the monthly sample period from January 2020 to March 2022. As per the discussion above, the result has indicated that there exist negative relationships between all variables observed and showed that three independent variables have a long-run relationship towards the GDP growth rate of Malaysia.

Although this study has faced the limitation of lacking a data sample period, other researchers may be able to observe more sample periods which will be more accurate in the future as time goes by. We also encourage future researchers to have comparisons of past, present and post Covid-19 pandemics and cover more variables in order to detect the impacts more obviously as references for policy implications in future.

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