MJBE Malaysian Journal of Business and Economics

THE EFFECT OF INFLATION RATE, INTEREST RATE AND UNEMPLOYMENT RATE ON THE ECONOMIC GROWTH OF MALAYSIA

Priscilla Dorothy Anak Impin and Sook Ching Kok
Faculty of Business, Economics and Accountancy,
Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia

*** Corresponding author's email:**
koksookching@ums.edu.my

Received: 19 April 2021

Accepted: 10 May 2021

Keywords: *economic growth, inflation rate, interest rate, unemployment rate, ARDL, Toda-Yamamoto causality test*

ABSTRACT

This study examines the effect of selected macroeconomics variables including inflation rate, interest rate and unemployment rate on the economic growth of Malaysia for the period of 2010 to 2018. To identify the effect of inflation, real interest rate, and unemployment on the gross domestic product (GDP), the long-run and short-run relationships between these variables are estimated. The Autoregressive Distributed Lag (ARDL) method is used for cointegration analysis. In the long run, the inflation rate has a positive impact on economic growth, meanwhile, the interest rate has a negative impact on economic growth. There is no evidence of a long-run relationship between the unemployment rate and economic growth. Based on the Toda-Yamamoto causality test, there is a uni-directional causal relationship from economic growth to the unemployment rate.

INTRODUCTION

What makes a country withstand a fierce strong competition in the international market is its economic growth. Economic growth refers to a consistent expansion of a national income or output (Pal, 2018) which mainly involves an increase in the flow of goods and services of an economy. A country without a sound economic condition will not be able to survive the outside world. This can be seen from many financial crises that hit many countries such as Mexico 1994, Asian countries 1997 – 1998,

and Argentina 2001 – 2002, just to mention a few, have very much affected the economic growth of the countries. The investigation concerning the factors that may increase or hamper economic growth has become one of the main focuses among researchers, but little concurrence has been reached to date.

The importance of economic growth has led booming of various studies on its determinants for effective policy formulation. Economic growth provides advantages for the people living in a country. Positive economic growth can lead to a reduction in poverty, improved health, longer lives, better living standard, more jobs creation, lower unemployment, provides political stability, etc. Economists often associate slow economic growth with a high unemployment rate, high poverty, and high interest rate which led to low borrowing for investment activities. Conversely, inflation is always regarded as a negative influence discussed by economists.

The variables in the study are inflation rate, interest rate, and unemployment rate. The effects of these selected variables are tested on the GDP performance of Malaysia as these variables are among those indicators that determine the economic growth of a country. High inflation rates and interest rates are causing negative effects on aggregate economic performance as a whole. The unemployment rate similarly, is one of those key indicators that depicts how well the market is growing (Babalola et al., 2015).

The inflation rate is generally defined as a general increase in the price level of a country in a certain period, whereby an increase in the price level of a country would lower the economic growth (Gokal & Hanif, 2004). This is because inflation raises the uncertainty concerning future investment profitability which leads to a more conservative investment and result in lower levels of growth. Furthermore, high inflation occurring in an economy will reduce the country's competitiveness globally, impacting the balance of payments of the country. Some say inflation is being detrimental to a country's economic growth, and some say the opposite. Most of the studies from previous researchers such as by Kasidi and Mwakanemela (2013) and Baglan and Yoldas (2014) proved that inflation is associated with lower economic growth. Despite the general fact that inflation affects growth negatively, an economy may be growing better despite the existence of inflation in an economy only if it is within a certain level of threshold. A positive relationship between inflation and economic growth can happen when the wage lag continues for a longer period. This condition would enhance the profit margin and thus produce incentives as well as the investible funds to the firms in an economy. This subsequently encourages investment activity which results in a higher level of output (Datta & Mukhopadhyay, 2011).

Interest rate, a key measure in the financial market, can potentially affect the economy as a whole. A country needs to sustain the high growth of the economy. Changes in interest rate can potentially affect the inflation rate in an economy, given that Fisher expresses real interest rate is the output of nominal interest rate minus the expected inflation rate (Investopedia, 2020). According to Babalola et al. (2015), nominal interest rates and inflation rates are historically closely associated. This association between those two variables can affect the economic activities in a country which tells us that the management in interest rate is essential.

Unemployment is created when there is an increase in the inflation rate. A country with a high unemployment rate is less likely to perform well in the economy. Unemployment and growth nexus is commonly described by Arthur Okun in his Okun's Law to have a negative association. According to him, for an economy to reduce its unemployment rate by one per cent, the real GDP of an economy should be accelerated by two per cent, which

is twice as much as its expected GDP growth (Investopedia, 2020). In Malaysia specifically, the unemployment rates were quite encouraging as it ranges from 2.9% to 7.4% from 1980 to 2018. Until the present, the trend of the unemployment rate in Malaysia is likely to be flat rather than decrease, while Malaysian GDP seems to be slightly fluctuating.

It is vital to determine the exact relationship of these determinants with economic growth in the case of Malaysia for a better understanding of a nation's economy. The need for inflation for economic growth has become a debate as it may promote or be detrimental to a growth of a country. Kasidi and Mwakanemela (2013) in the study mentioned that Latin American countries that have a high rate of inflation had to face a decrease in economic growth and thus creating negative views on inflation toward economic growth. Previously, it was believed that inflation is viewed as a positive determinant of economic growth as it helps in lowering the unemployment rate of a country. The emergence of inflation started to be regarded as a problem was in the 1970s when Latin American countries' economic growth decreased as inflation rose.

Price stability, suitable unemployment rate and interest rate value is important to achieve sustainable economic growth. It is so important that the economic, social, and political structure may suffer if a nation fails to establish these conditions. In other words, economic growth is derived from these indicators and there is a need to figure out how deep do these indicators affect economic growth. The relationship between these indicators and economic growth has frequently been discussed in economic literature. However, this relationship has not been discussed enough especially for Asian developing countries including Malaysia.

This study will be undertaken to examine the effects of inflation, interest rate and unemployment on the economic growth of Malaysia. Some potential benefits can be obtained by society after the completion of the study. Some of the studies have shown how this key macroeconomics can affect a country's economic growth. Therefore, policymakers can be more efficient in formulating effective policies that can help in boosting economic growth. For future researchers, the findings of the study can help them to provide a clearer view of Malaysia economic condition. This may act as a reference to them as they are more aware of what to expect and thus can do better in analyzing Malaysia economic growth. Besides that, society is exposed to the current economic conditions and have an insight into how a macroeconomic indicator can affect the economic growth of a country and thus can understand how an economy is working as a whole.

LITERATURE REVIEW

Inflation

Almost all of the selected literature stated that inflation provided a negative impact on economic growth. For example, Kasidi and Mwakanemela (2013) studied the impact of inflation on Tanzanian economic growth. They utilized correlation coefficient and co-integration techniques to find the negative impact of inflation on economic growth. They also observed that there was no co-integration between those two variables and further revealed that no long-run relationship was detected during the period of study. Next, Singh and Kalirajan (2003) conducted an empirical study concerning the relationship between inflation and growth of India found that inflation increases would negatively impact India's economic growth and suggested that if India were to maintain its price stability, substantial gains could be achieved.

The rest of the literature focused more on the threshold level of inflation that will negatively impact growth. Inflation is being detrimental to economic growth if it surpasses a certain level of threshold and is said to promote growth if it is below or less than the threshold value. Threshold value will act as a standard for an economy and is important in developing its financial policies. For instance, Baglan and Yoldas (2014) revealed that inflation had become a detriment to developing economies' growth only after it was lower than the implied threshold rate which is 12%. Lopez and Mignon (2011) investigated if the inflation level matters had concluded that inflation would be detrimental to the economic growth if it passed a certain threshold level and was non-linearly impacting both industrialized and emerging economies. Given the estimated threshold level for advanced economies was 2.7%, while 17.5% for emerging economies, the study suggested the difference in the level of inflation would cause the monetary policy to differently affect the GDP of each economy. Vinayagathasan (2013) observed a non-linearity of the relationship between inflation and economic growth in the case of 32 Asian countries. They applied the Dynamic Panel Threshold Growth Regression technique and observed that any increase of more than 5.43% in inflation level would hurt economic growth. Seleteng, Bittencourt and Eyden (2013) had endogenously determined the inflation level for the Southern African Development Community (SADC) region in examining the relationship between inflation and growth. They employed the Panel Smooth Transition Regression (PSTR) technique for panel data and observed the non-linearity, which resulted in a threshold level of above 18.9% had a negative impact on the economic growth of those regions.

A few research have been found studied on the effect of inflation on the growth during crises. Among them was the study done by Bittencourt (2012). Bittencourt had empirically confirmed that inflation negatively impacted four Latin American countries, Brazil, Argentina, Bolivia, and Peru during the hyperinflationary crises. According to Bittencourt, the Mundell-Tobin effect can be offset by high inflation which causes high costs on the economic activity of the observed regions. Inflation causes uncertainty in macroeconomic which subsequently induces agents to less productive economic activities.

Interest Rate

When inflation is expected to rise, the Central bank will usually raise its interest rate as a precautionary step (Economics Help, 2019). Generally, an increase in interest rate would cause the cost of borrowing to rise, which will decelerate the investment activities in a country. This subsequently results in slower economic growth. Most of the research concluded that interest rate has a negative relationship with the economic growth of a country.

For instance, Udoka and Anyingang (2012) examined the effect of fluctuation in the interest rate on Nigerian economic growth by using the Ordinary Least Square Multiple Regression Analytical (OLS-MRA) technique. Their study concluded a negative relationship between the two variables and suggested a strong formulation of monetary policy in enhancing the lending activities in the real sector economy. Semuel and Nurina (2015) employed the Partial Least Square (PLS) technique and observed a negative relationship between interest rate and GDP and insignificant influence of inflation on GDP.

Research by Jordaan (2013) combined a macroeconomic model and social accounting matrix in examining the impact of an increase in the interest rate on the economy and found that a reduction of .54% in nominal GDP when the interest rate increased. In studying the employment of South African countries, the result indicated the employment opportunities were dropped. They further extend their study concerning

the impact of the increase in the interest rate on households and found that high-income households were more likely to be impacted by this event. Maiga (2017) and Jelilov (2016) in the study of determining the effect of interest rate on Nigerian growth concluded a slight impact on growth was detected and it can be improved by lowering the interest rate to enhance the investment activity.

Babalola et al. (2015) aimed to determine the impact of inflation and interest rate on Nigerian economic growth. The techniques employed in the study was OLS, Johansen Integration test and Augmented Dickey-Fuller (ADF) test. The study confirmed the negative impact of the two variables on growth and no evidence of inflation and interest rate Granger caused the growth of Nigeria was found. Bosworth (2014) used data from large economies to show the influence of foreign interest rates and found a weak connection between real interest rates and economic growth.

Bhat and Laskar (2016) used Multiple Linear Regression (MLR) to investigate the impact of interest rate and inflation rate changes on India's GDP. The study observed a strong and positive correlation of the variables. Bhat and Laskar further showed that 32% changes in GDP were explained by the interest rate and inflation rate if they were combined. A negative nexus between GDP and interest rate and a positive nexus between GDP and inflation rate were detected.

Mushtaq and Siddique (2016) believed that the most important tools for economic growth are savings and investments and the determinant of these two tools is the interest rate. They conducted a study to investigate the impact of interest rates on Islamic and non-Islamic economies performance. They used the data from 17 non-Islamic and 17 Islamic countries accounting from 2005 to 2013 period. Their study found that interest rate, income per capita, and inflation had a significant impact on saving meanwhile government spending had a negative impact on saving in non-Islamic countries. The results differed in Islamic countries as they were not concerned about the interest rate earned from saving. Compared to non-Islamic countries,

Unemployment

The relationship between unemployment and economic growth is often explained by using Okun's Law. Most of the literature found are based on Okun's Law. Okun's Law is generally stating that for an economy to reduce its unemployment rate, a country's real GDP must grow approximately twice as fast as the growth of potential GDP within a certain period (Furhmann, 2020). This indicates that the unemployment rate and economic growth will have a negative relationship.

This theory is somehow validated by only a few literature as some of them are not able to validate Okun's Law. For instance, Elshamy (2013) tested Okun's coefficient that was based in Egypt from 1970 to 2010. Elshamy utilized the co-integration analysis and ECM to investigate the coefficients for long-run and short-run. The result was consistent with Okun's Law rationale. Dogru (2013) had employed a similar approach to study the implementation of Okun's Law in the case of the Eurozone and its coefficient was found to be valid and varying across the countries in Eurozone. A study by Zaleha et al. (2007) tested for Okun's Law in the case of Malaysia. A negative relationship between unemployment and output growth was found in the study. Apart from that, the Granger causality test showed a bidirectional causality between the variables. The study had concluded that an increase in output growth would decrease the unemployment rate and vice versa.

Christopoulos (2003) conducted a similar study in the case of Greek regions. The sample was divided into thirteen regions. Christopoulos used the cointegration

technique and found a long-run relationship between unemployment and output growth and only six out of thirteen regions confirmed Okun's Law. Schubert and Turnovsky (2018) revealed a weak long-run trade-off but a strong short-run trade-off between unemployment and growth. The weak trade-off was because unemployment, in the long run, was mainly driven by labour market tightness, while growth was driven by the output-capital ratio which had caused the effect of structural characteristics on production capacity to be observed in economic growth while the little impact on unemployment was detected.

Dritsakis and Stamatiou (2016) tested the effect of unemployment on Greece economic growth by using Autoregressive Distributed Lag and Error Correction Model approach and found out that there existed both long-run and short-run relationships between unemployment and economic growth. Their study also found that unemployment Granger causes economic growth, indicated a unidirectional causality between the variables. Other than that, the study also examined for causality relationship between inflation and economic growth and found a similar outcome, which was inflation Granger caused economic growth.

While some found their studies were in line with Okun's Law, some studies were opposite to Okun's Law. For example, Sadiku et al. (2015) studied the economic growth and unemployment rate in FYR of Macedonia based on Okun's Law. They employed four models known as the difference model, dynamic model, Error Correction Mechanism, and VAR estimation approach. The result was opposed to Okun's Law whereby there was no evidence of any inverse linkage between the two variables. Besides, no causality between unemployment and growth was detected and the unemployment rate did not seem to Granger caused economic growth and vice versa. According to Sadiku et al. (2015), this might be the case there were massive informal employment in Macedonia which accounted for roughly one-fourth of its employment, structural unemployment issues as well as unsuitable formulated economic policies concerning its development and unemployment.

Kuso and Gachunga (2019) studied the nexus between unemployment and economic growth in the case of Kenya. The analytical tools that they used were Johansen Cointegration, error correction model as well as Granger causality model. The results found that there was a positive long-run relationship between the two variables. The Granger causality model used in the study indicated a unidirectional causality from unemployment to economic growth. Makaringe and Khobai (2018) conducted a similar study and focused on South Africa's case by using quarterly data ranging from 1994 to 2016. The study used the ARDL technique to reveal the long-run nexus between the variables and the result seemed to confirm a negative long-run relationship between the two variables. Not only that, but the study also confirmed a negative short-run relationship between unemployment and the economic growth of South Africa.

METHODOLOGY

Data

The time series used in this study is quarterly time series that ranged from 2010 to 2018. The data was obtained from Bloomberg. GDP is defined by the Bureau of Economic Analysis as the value of goods and services produced within a nation. GDP will be the dependent variable in this study, meanwhile, the independent variables are inflation rate, interest rate and unemployment rate. Inflation is commonly associated with the purchasing power of consumers. A high inflation rate means a low purchasing power of the consumers as they can only buy less of the basket of goods compared to when the inflation was relatively low. Interest rate

is defined as a value that is earned from an investment or saving (Semuel & Nurina, 2015). The unemployment rate although is not the most important variable in explaining economic growth, however, it does play an important role in assisting the growth of an economy. According to Federal Reserve, a country is said to have a good economy as long as its unemployment rate is ranged from 3.6 to 4.5 per cent. If a country operates at its full capacity, it is believed that it would accelerate the economic growth of a country. Hence, unemployment does play a significant role in depicting the current economic condition of a country.

Method of Analysis

Unit Root Test

Unit root test is mainly used to detect any element that could lead to the insignificance of the parameter estimates. A series is known to be not stationary if the series has a unit root. Conversely, if a series does not contain any unit root in it then it is known to be stationary. The stationarity of a series can influence the properties where there will be infinite persistence of shock for non-stationary series. When the series is detected to be not stationary, the standard assumptions for asymptotic analysis is said not valid. This will affect the outcome as researchers cannot validly prove the hypothesis testing of the regression parameters. There are two types of tests used in this study namely the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Both are used to test for the stationarity of a series.

ADF test will depict if there is a stationary trend in the time series, and determine the order of integration if the series is detected to be not stationary. This is important so none of the series is integrated at a higher level than the first difference to avoid spurious results. However, when testing for unit root, it is vital to be more cautious as the tendency to Type 1 error rate is high. Type I error happens when a true null hypothesis is being rejected, while Type II error happens when a false null hypothesis is being accepted when it is supposed to be rejected. The rejection rule for the ADF unit root test is that the null hypothesis can be rejected when the t-statistic is greater than the significant level of critical value. where the presence of a unit root in the series means that the series is not stationary which represents the inconstancy of the series over time.

Co-Integration Test

The cointegration test analyzes the long-run relationship between the variables. There are three possible outcomes when performing cointegration tests which are known as cointegrated, no cointegration, and inconclusive. For example, if the computed test-statistic is greater than the upper bound of critical values, then cointegration exists among the variables. However, if the test statistic is less than the lower bound of critical values, then there is no cointegration among the variables which leads to the non-rejection of the null hypothesis. If the test statistic value falls in between the lower and upper bound of the critical values, the test is inconclusive. The equation for the Bounds test is as follows:

$$\alpha(L,p)y_t = \alpha_0 + \sum^{k}_{(i=1)} \square i(L,q_i)x_{i,t} + \mathcal{E}_t ,$$

where α_0 is a constant, y_t is the dependent variable, L is a lag operator, $x_{i.t}$ is vector regressors, and $\mathcal{E}_t$ is disturbance term.

Autoregressive Distributed Lag (ARDL) Test

This study employs the ARDL approach because this model allows series that has a different order of integration. Qamruzzaman and Wei (2018) stated that ARDL is more superior compared to other cointegration models as it considers the different sizes of samples. This study consists of 36 observations from quarterly data and this fits ARDL well. Qamruzzaman and Wei (2018) also mentioned

that this model is suitable for series that are integrated in a different order.

Toda-Yamamoto Granger Causality Test

The Toda-Yamamoto causality test will be used to examine the short-run relationship of the variables. The approach is based on the Vector Autoregressive framework proposed by Toda and Yamamoto in 1995. The result of the F-test statistic is not valid when the variables are cointegrated and proposes an approach to test for causality but with modified WALD. The lag length for the variables is set according to the majority suggestion by criterion. Toda-Yamamoto approach to causality test is an augmented Granger non-causality equation with extra lags from the highest order of integration of the variables, which is 1. The estimation of VAR will require:

$$\mathbf{k + d_{max}}$$

where, k is the optimal lag length, and d_{max} is the maximum order of integration of the model.

RESULTS

Univariate Unit Root Test

Table 1 reports the results of the ADF and PP unit root tests for the four variables for levels and the first differences of the natural log values. The study adopts a model with constant in this analysis. The optimal lag lengths of the series for both ADF and PP were chosen by Schwarz Information Criterion (SIC). For the LGDP, the value for the ADF test is .9372, and .8588 for the PP test which is greater than 1 per cent significance level when it is tested in level. The value then becomes stationary after the first difference whereby the value for ADF and PP are 0.0030 and 0.0000 respectively. Similarly, the LINF values for both ADF and PP are not significant at the level and only become stationary at the first difference. As for LINT, both values for ADF and PP are stationary at the level at 1 per cent significance level and still stationary after going through the first difference. Lastly, for LURATE, the values are not stationary at a level and become stationary at first difference.

To conclude, after running the ADF and PP tests for all of the variables, it is observed that the variables have a mixed order of integration which is at I(0) and I(1). The results thus further lead to a co-integration test, which is best to be done when some of the series appeared to be non-stationary and the Autoregressive Distributed Lag (ARDL) test will be conducted as the model has a different order of integration.

Table 1 Augmented Dickey-Fuller (ADF) and Phillips-Perron Test Results for Unit Root

Variables Level	**Augmented Dickey-Fuller**		**Phillips-Perron**		**Decision**
	1st Difference	Level	1st Difference		
LGDP	0.9372	0.0030	0.8588	0.0000	I (1)
LINF	0.8610	0.0002	0.6505	0.0001	I (1)
LINT	0.0002	0.0001	0.0002	0.0001	I (0)
LURATE	0.1683	0.0002	0.1270	0.0000	I (1)
H_0:	Variable has a unit root				
H_1:	Variable has no unit root				

Cointegration Bound Test

Table 2 shows the results of the cointegration bound test. It is reported that the test is highly significant at a 1 per cent significance level. This implies the rejection of the null hypothesis which stated there is no cointegration between the variables. It is confirmed that there is a presence of long-run dynamic between the dependent and independent variables with an F-statistic of 15.07971, which exceeds the upper bound of critical value. Other than that, when inflation is taken as a dependent variable, there is no cointegration as the result of the F-statistic of inflation (2.576814) falls below the lower critical bound of 2.676 at the 1 per cent significance level. When the unemployment rate is set as the dependent variable, the F-statistic of 2.568297 falls below the lower critical bound of 2.676 at the 1 per cent significance level. Similar to the inflation rate, the result shows no evidence of an existing relationship. However, the result found that there was a long-run relationship when the interest rate was set as a dependent variable as F-statistic is 10.17906 at a 10 per cent significance level.

Table 2 Cointegration test result

Test Statistic	Value	Sig. Level	Bound Critical Value (Restricted Constant and No Trend)	
			Finite Sample, n=30	
			I(0)	I(1)
F-Statistic	15.07971	10%	2.676	3.586
k	3	5%	3.272	4.306
Actual Sample Size	32	1%	4.614	5.966

$F_{linf}(.) = 2.576814$, $F_{lint}(.) = 10.17906$, $F_{lurate}(.) = 2.568297$

Long Run Estimation by Using Autoregressive Distributed Lag (ARDL) Test

ARDL test is used when the series has a different order of integration. Table 1 shows that all variables except interest rate are integrated at first difference while the interest rate is integrated at level; hence, it is wise to employ the ARDL test in this case. Table 4.3 shows the estimated results for the ARDL model that is built by using inflation rate, interest rate and the unemployment rate as predictors to ascertain their influence on the economic growth of Malaysia. The chosen optimal lag length is based on Schwarz Criterion (SC) and ARDL (4,0,0,0) is suggested.

Table 3 Estimated long-run coefficients

ARDL (4, 0, 0, 0) Selected based on Schwarz Criterion (SC)				
Dependent Variable: LGDP				
Regressor	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LINF	0.011334	0.005626	2.0114754	0.0553**
LINT	−0.185656	0.108093	−1.717560	0.0988**
LURATE	−0.040404	0.076302	−0.529521	0.6013
C	−0.111442	0.339559	−0.328195	0.7456

The result shows that LINF and LINT are both significant at a 10 per cent significance level. The result revealed that inflation has a significant positive impact on Malaysia economic growth. Specifically, in the long run, an increase in inflation will lead to an increase in GDP by 0.01 per cent. Conversely, the interest rate has a significant negative impact on GDP in the long run. To be precise, an increase in interest rate will lead to a decrease in GDP by 0.19 per cent in the long run. Meanwhile, the unemployment rate has an insignificant negative impact on GDP where an increase in the unemployment rate will drop the GDP by 0.04 per cent.

Diagnostic Test

The diagnostic test in this section is based on the ARDL model. The diagnostic tests that have been conducted in the study are the Breusch-Godfrey serial correlation LM test, Arch heteroscedasticity test and Jarque-Bera normality test. The results are presented in Table 4.4 below. The model has a p-value that is less than 5 per cent of significance level which leads to the rejection of the null hypothesis of no serial correlation and accept the alternative hypothesis of the existence of a serial correlation between the variables. Based on the Arch Heteroscedasticity test, the variables are free from the problem of heteroscedasticity as the p-value is greater than 5 per cent of significance level which leads to failure in rejection of the null hypothesis of homoscedasticity. Next, the data in the study is normally distributed when the p-value is greater than the 10 per cent significance level of 0.6796.

Table 4 Diagnostic test

Test	Probability	Conclusion
Correlation test	0.0258	There is a serial correlation
Breusch-Godfrey Serial Correlation LM Test		
Heteroscedasticity test	0.3058	The residual is homoscedasticity
Arch Heteroscedasticity Test		
Normality test	0.092781	The population is normally distributed
Jarque-Bera Normality Test		

Serial Correlation

H_0: Variable has a unit root

H_1: Variable has no unit root

Heteroscedasticity

H_0: The residuals are homoscedasticity

H_1: The residuals are heteroscedasticity

Normality

H_0: The population is normally distributed

H_1: The population is not normally distributed

VAR Lag Order Selection Criteria

The inference in the vector autoregressive (VAR) model is dependent on the lag order, hence is important in the study.

Table 5 Lag Length Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	99.02297	NA	3.71e-08	−5.758968	−5.577573	−5.697934
1	200.9790	173.0162*	2.04e-10*	−10.96842	−10.06145*	−10.66325*
2	213.6990	18.50183	2.62e-10	−10.76963	−9.137081	−10.22033
3	233.8161	24.38444	2.31e-10	−11.01916*	−8.661027	−10.22572

Table 5 above presents the optimal lag length to be used in a standard VAR model by a few selected criteria. The optimal lag length selected is based on the majority selection which is 1, therefore the maximum lag length is decided to be one. Optimal lag length selection is needed to satisfy k+dmax where k represents optimal lag, dmax represents the maximum order of integration in the Toda-Yamamoto causality test.

Toda-Yamamoto Causality Test

Granger causality test is conducted to determine whether the variables have a significant effect on each other. Table 6 reports the results of the Toda-Yamamoto of Granger Causality with the Wald test. The optimal lag length is 1 and the highest order of integration is 1. Therefore, the k+dmax is 2. The degree of freedom that has been used in the test is 1.

Table 6 Granger causality test using Toda-Yamamoto framework

Variables	Coefficient (Probability)	Granger causality
LINF → LGDP **LGDP → LINF**	0.561462 (0.4537) 0.005000 (0.9436)	No causality
LINT → LGDP **LGDP → LINT**	0.123798 (0.7250) 0.421713 (0.5161)	No causality
LURATE → LGDP **LGDP → LURATE**	1.867051 (0.1718) 5.691418 (0.0170)*	Uni-directional
LINT → LINF **LINF → LINT**	0.074815 (0.7845) 0.005581 (0.9404)	No causality
LURATE → LINF **LINF → LURATE**	1.958140 (0.1617) 1.053695 (0.3047)	No causality
LURATE → LINT **LINT → LURATE**	1.906458 (0.1674) 1.154813 (0.2825)	No causality

*significant at 5%

Table 6 shows the result from the Wald test. The null hypothesis rejection rule for the Granger causality test is that the calculated probability value must be not more than a significant value of 5 per cent. If the value is less than 5 per cent, the null hypothesis will be rejected and thus the alternative hypothesis will be accepted. The hypothesis is summarized as follow:

H_0: Y does not Granger cause X

H_1: Y does Granger cause X

For the first causality test, the study tests for the causality between variables GDP and inflation rate. The result shows that LGDP does not granger cause LINF and so does LINF does not granger cause LGDP. Therefore, both variables are indicated to be no causality as they are not affected by each other.

For the second relationship, the study tests for the causality between interest rate and GDP. The result for the relationship shows that LINT does not granger cause LGDP and LGDP too, does not granger cause LINT. Therefore, it is decided that both variables are not being affected by each other as no causality was found between them.

For the third relationship, the study tests for the causality between the unemployment rate and GDP. The result for the relationship found that LURATE does not granger cause LGDP, however, LGDP does granger cause LURATE. Therefore, a uni-directional causality was found between the variables as there is the only unemployment rate is affected by GDP.

For the fourth relationship, the study tests for the causality between interest rate and inflation rate. The result for the relationship reveals that LINT does not granger cause LINF and so does LINF does not granger cause LINT. Therefore, the two variables are concluded to have no causality between them.

For the fifth relationship, the study tests for the causality between the unemployment rate and the inflation rate. The result for the relationship reveals that LURATE does not granger cause LINF and LINF does not granger cause LURATE too. Therefore, the variables have no causality as both are not affected by each other.

For the sixth relationship, the study tests for the causality between the unemployment rate and interest rate. The results for the relationship found that LURATE does not granger cause LINT and LINT does not granger cause LURATE. Since both variables are not being able to be affecting each other, the variables are decided to have no causality between them.

Heteroscedasticity Test

Table 7 VAR Residual Heteroscedasticity Test (Levels and Squares)

Chi-sq	df	Prob.
177.9070	160	0.1580

Table 7 shows the value of probability is greater than the 5 per cent significance level which implies there is no heteroscedasticity in the series. This means that the null hypothesis is failed to be rejected at a 5 per cent significance level.

Normality Test

The normality test is to check whether the residuals are normally distributed. The null hypothesis of the test is residuals are normally distributed against the alternative hypothesis that the residuals are not normally distributed.

Table 9 VAR residual normality test

Component	Skewness		Kurtosis		Jarque-Bera	
1	–0.167840	0.6895	2.875898	0.8826	0.181450	0.9133
2	0.779669	0.0635	4.778847	0.0342	7.927433	0.0190
3	0.482179	0.2510	2.500086	0.5518	1.671525	0.4335
4	–0.767220	0.0678	3.865362	0.3030	4.396421	0.1110
Joint	0.0826		0.2052		14.17683	0.0773

From Table 9, it is observed that the skewness of the variables is suggested to be normally distributed as the p-value of each of the components are greater than 5 per cent. The joint p-value is also greater than 5 per cent indicates that the variables are multivariate normal. As for the kurtosis of the variables, all of the individual components are normally distributed except for component 2 which is less than 5 per cent. However, the joint p-value is greater than 5 per cent which shows that the variables are jointly multivariate normal.

Based on the overall skewness and kurtosis, the null hypothesis of the residuals is normally distributed cannot be rejected. Based on the Jarque-Bera statistics, each of the individual components is normally distributed except for component 2. The joint p-value is greater than 5 per cent which indicates that the joint variables are multivariate normal which is good for the VAR model.

To conclude all of the three tests that have been conducted above, the tests have proven that the model is appropriate for prediction. The tests have satisfied the condition of normality of the residuals, residuals are free from correlation, and the residual is homoscedasticity.

CONCLUSION

The analysis is starting from the unit root test. The unit root tests that are conducted by using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests have revealed that all variables except interest rate are stationary at first difference. Precisely, LGDP is found to be stationary at the first difference at a 1 per cent significance level for both tests. Similar to LGDP, LINF and LURATE too are stationary at the first difference at 1 per cent significance level for both ADF and PP tests. ADF and PP tests for LINT are found to be stationary at a 1 per cent significance level. As a record, when LINT was the first difference, both of the test values are still stationary at a 1 per cent significance level.

Since the unit root tests are found to have a mixed order of integration between I(0) and I(1), the study has conducted the co-integration test with LGDP to be the dependent variable. The result has revealed that the model variables possess a long-run dynamic relationship with its F-statistic value far exceeding the upper bound critical value. Apart from that, the study also has conducted another three separated co-integration tests with LINF, LINT and LURATE as the dependent variable. When LINF and LURATE are set to be the dependent variable, there is no existing relationship between the model variable as the F-statistic values were fell below the lower bound critical value. However, LINT shows a positive outcome with an F-statistic value that exceeded the upper bound critical value.

Following this, the ARDL test has been conducted to determine the long-run relationship between the model variables. The results show a mixed outcome whereby both LINF and LINT have a significant effect on LGDP at a 10 per cent significance level, meanwhile, LURATE shows an insignificant effect on LGDP of Malaysia from 1980 to 2018. INF was found to have a positive relationship with LGDP, while LURATE, on the other hand, has a negative relationship with LGDP.

The study has conducted the causality test between the variables by using the Toda-Yamamoto framework. The results reveal only the variables LURATE and LGDP were found to have a uni-directional causality. LGDP is found to granger cause LURATE, while LURATE does not granger cause LGDP. The other remaining model variables show no granger cause on LGDP in any direction.

We found that the inflation rate has a positive effect on the economic growth of Malaysia. Some studies support the finding of this study. For example, Naseri and Zada (2013) used the Ordinary Least Squares (OLS) method in their study and found a similar result in the case of Malaysia from 1980 to 2010. Furthermore, Bhat and Laskar (2016) in their study have successfully shown that the nexus between GDP and inflation rate is positive. The study took place in India and was conducted by using Multiple Linear Regression. A study by Sattarov (2011) that used the error correction model concluded a positive long-run relationship between Finland's inflation rate and its economic growth. The study also pointed out that Finland's economy is at its highest when the inflation rate was found to be 4 per cent.

The relationship between interest rate and economic growth is negative. The relationship between the two variables is supposed to be negative such that a high interest rate would increase the borrowing cost and eventually decelerate the economic growth. The finding in this study is supported by a few studies that have been done before. For example, Udoka and Anyingang (2012) also found that the fluctuation in the Nigerian interest rate would negatively impact its economic growth. This study, therefore, has strongly suggested that a strong monetary policy is required to boost lending activities, especially in a real sector economy.

Maiga (2017) and Jelilov (2016) in two different studies in the case of Nigeria also have found similar outcomes and stressed that economic growth can be boosted by focusing on investment activity. Similarly, a negative relationship was found between the interest rate and the GDP of Indonesia (Semuel & Nurina, 2015). A study by Jordaan (2013) has also observed a reduction of 0.54% in South African nominal GDP when the interest rate is increased.

The relationship between the unemployment rate and economic growth is negative. This is in line with the general view of the nexus between the two variables. The general view of the relationship between unemployment and economic growth is commonly explained by Okun's Law. In Okun's Law, the GDP of a country must grow approximately twice the growth of its potential GDP so that it can reduce its unemployment rate (Furhmann, 2020).

The finding in this study is supported by Elshamy (2013) and Dogru (2013), such that their studies in Egypt and Eurozone respectively, have found that the relationship between the unemployment rate and economic growth is negative. A study in the case of South Africa by Makaringe and Khobai (2018) and Zaleha et al. (2007) in the case of Malaysia also found a negative relationship between unemployment and economic growth, similar to the result in this study.

REFERENCES

Babalola, O. O., Danladi, J. D., Akomolafe, K. J., & Ajiboye, O. P. (2015). Inflation, interest rates and economic growth in Nigeria. *European Journal of Business and Management*, 7 (30), 91 – 102.

Baglan, D., & Yoldas, E. (2014). Non-linearity in the inflation-growth relationship in developing economies: Evidence from a semiparametric panel model. *Economic Letters*, *125*, 93 – 96.

Bhat, S. A., & Laskar, M. R. (2016). Interest Rate, Inflation Rate and Gross Domestic Product of India. *International Journal of Technical Research & Science,* 1 (9), 284 – 288.

Bittencourt, M. (2012). Inflation and economic growth in Latin America: Some panel time-series evidence. *Economic Modelling*, *29*, 333 – 340.

Bosworth, B. P. (2014). Interest rates and economic growth: Are they related? *Centre for Retirement Research of Boston College*, 1 – 26.

Christopoulos, D. K. (2003). The relationship between output and unemployment: Evidence from Greek regions. *Papers in Regional Science*, 611 – 620.

Datta, K., & Mukhopadhyay, C. K. (2011). Relationship between inflation and economic growth in Malaysia – An econometric review. *International Conference on Economics and Finance Research IPEDR*, *4*, 415 – 419.

Dogru, B. (2013). The link between unemployment rate and real output in Eurozone: A panel error correction approach. *Procedia – Social and Behavioral Sciences*, *99*, 94 – 103.

Dritsakis, N., & Stamatiou, P. (2016). The effects of unemployment of economic growth in Greece: An ARDL bound test approach. *The Romanian Economic Journal*, 19 (62), 53 – 72.

Elshamy, H. (2013). The relationship between unemployment and output in Egypt. *Procedia- Social and Behavioral Sciences*, *81*, 22 – 26.

Furhmann, R. (2020, April 21). Okun's Law: Economic growth and unemployment. *Investopedia*. https://www.investopedia.com/articles/economics/12/okuns-law.asp

Gokal, V., & Hanif, S. (2004). Relationship between inflation and economic growth. *Working Paper 2004/04 Economics Department Reserve Bank of Fiji*, 1 – 51.

Jelilov, G. (2016). The impact of interest rate on economic growth example of Nigeria. *African Journal of Social Sciences*, *6* (2), 51 – 64.

Jordaan, J. C. (2013). Impact of interest rate changes on South African GDP and households: A combined macroeconomic and social accounting matrix modelling approach. *Southern African Business Review*, *17*(3), 156 – 186.

Kasidi, F., & Mwakanemela, K. (2013). Impact of inflation on economic growth: A case study of Tanzania. *Asian Journal of Empirical Research*, *3* (4), 363 – 380.

Kuso, Y., & Gachunga, M. J. (2019). An analytical study of the impact of unemployment on economic growth in Kenya. *International Journal of Business Marketing and Management (IJBMM)*, *4* (4), 52 – 57.

Lopez, V. A., & Mignon, V. (2011). On the impact of inflation on output growth: Does the of inflation matter. *Journal of Macroeconomics*, *33*, 455 – 464.

Maiga, F. K. (2017). Impact of interest rate on economic growth in Nigeria. *Pyrex Journal of Business and Finance Management Research*, *3* (3), 98 – 111.

Makaringe, S. C., & Khobai, H. (2018). The effect of unemployment on economic growth in South Africa (1994-2016). *MPRA Paper No. 85305*, 1-15.

Mushtaq, S. & Siddiqui, D. A. (2017). Effect of interest rate on bank deposits: Evidence from Islamic and non-Islamic countries. *Future Business Journal*, *3* (1,) 1 – 8.

Pal, R. (2018, February). *Chapter 5: economic growth, inflation and unemployment*. https://www.researchgate.net/publication/323383852_Economic_Growth_Inflation_and_Unemployment

Qamruzzaman M., & Wei, J. (2018). Financial innovation, stock market development, and economic growth: An application of ARDL model. *International Journal of Financial Studies*, *6* (3), 1 – 30.

Sadiku, M., Ibraimi, A., & Sadiku, L. (2015). Econometric estimation of the relationship between unemployment rate and economic growth of FYR of Macedonia. *Procedia Economics and Finance*, *19*, 69 – 81.

Schubert, S. F., & Turnovsky, S. J. (2018). Growth and unemployment: Short-run and long-run tradeoffs. *Journal of Economic Dynamics & Control*, *91*, 172 – 189.

Seleteng, M., Bittencourt, M., & Eyden, R. V. (2013). Non-linearities in inflation-growth nexus in the SADC region: A panel smooth transition regression approach. *Economic Modelling*, *30*, 149 – 156.

Semuel, H., & Nurina, S. (2015). Analysis of the effect of inflation, interest rates, and exchange rates on gross domestic product (GDP) in Indonesia. *Proceedings of the International Conference on Global Business, Economics, Finance and Social Science (GB15_Thai Conference)*, 1 – 13.

Singh, K., & Kalirajan, K. (2003). The inflation-growth nexus in India: An empirical analysis. *Journal of Policy Modeling*, *25*, 377 – 396.

Udoka, C. O., & Anyingang, R. A. (2012). The Effect of Interest Rate Fluctuation on the Economic Growth of Nigeria, 1970-2010. *International Journal of Business and Social Science*, *3* (20), 295 – 302.

Vinayagathasan, T. (2013). Inflation and economic growth: a dynamic panel threshold analysis for Asian economies. *Journal of Asian Economics*, *26*, 31 – 41.

Zaleha, M. N., Norashidah, M. N., & Judhiana, A. G. (2007). The relationship between output and unemployment in Malaysia: Does Okun's law exist? *International Journal of Economics and Management*, *1* (3), 337 – 344.