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Does monetary policy affect economic growth: evidence from Malaysia

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Abstract

Purpose – The purpose of this paper is to investigate the relationship between monetary policy and economic growth in the light of a developing economy, with the main focus on Malaysia. Primarily, the research will concentrate on the interactions between interest rates, inflation, money supply and growth in GDP, which will serve as the instrument for measuring economic growth.

Design/methodology/approach – The research will apply quantitative analysis to determine the relationship between GDP growth and monetary policy instruments, particularly interest rate, money supply and level of inflation. Given the advancement and achievement in econometric analysis and computer software creation, the least-squares estimates analysis will be used to investigate the relationship and significance between these variables.

Findings – It is observed that relationship between economic growth and inflation is positive. This entails that a 1 percent change in inflation will result in a 77 percent increase in the level of economic growth in this economy. The linkage between economic growth and interest rates has also been observed to be positive. A positive nexus can be observed between economic growth and money supply. The coefficient value of 0.02 for money supply growth shows that it has the smallest effect on economic growth amongst the variables tested in the model.

Research limitations/implications – Based on the findings of this study, the following recommendations can be made, which could serve as policies instruments for Malaysian economic development. This does not mean that the findings can be generalized for other developing economies.

Practical implications – Observations from the test for economic application significance are based on the signs of the parameters. It was observed that inflation, interest rates and money supply all have a positive relationship with economic growth, which is in line with the a priori expectations. This means that monetary policy has positively affected the economic growth.

Social implications – The results of the OLS analysis reveal that the monetary policy instruments used for the model demonstrated that monetary policy has a positive relationship with economic growth in Malaysia. A breakdown of the individual monetary policy instruments shows that the interest rate, inflation and money supply all have individual positive relationships with economic growth.

Originality/value – A positive relationship exists between economic growth in Malaysia and all selected monetary instruments, namely, inflation, money supply and interest rate. The results show that the results show that inflation, interest rate and money supply will cause the economy to grow but their contribution to the developments is affected from other policy instruments which are used by the governments.

Keywords Economics, Economic growth in Malaysia, Monetary policy, Ordinary least squares, Quantity theory of money

Paper type Research paper

Introduction

The aim of this study is to investigate the effects of monetary policy on economic growth, with Malaysia as the case study. In this study, Malaysia is selected because of the developmental strides that the Malaysian economy has experienced in the past several decades and as the case of Malaysia can be adopted as a role model for many developing countries in their attempts to improve their economies. Malaysia is an upper middle income developing country with a population of 29.90 million (2014 est). The methodology applied in this study

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incorporates time series analysis using the ordinary least squares (OLS) regression estimates. The sample of the study covered between 1985 and 2014. The stationarity test is conducted and all variables, both dependent and independent, are found to be stationarity at level, which indicates that the OLS regression analysis could effectively measure the relationship between the variables. Furthermore, the researchers have tested the structural stability of the model. Autocorrelation and heteroscedasticity tests are conducted to ensure that the estimates from the result of the analysis are as accurate as possible.

The major contribution of this study differs from other studies because in this study, effects of the monetary policy on economic growth is investigated. The results of this research give rise to some issues, of which money supply growth does not explain a whole lot of the economic development in the economy of Malaysia and monetary stability can contribute toward price stability.

The main result of the OLS analysis reveal that the monetary policy instruments used for the model showed that monetary policy has a positive relationship with economic growth in Malaysia. A breakdown of the individual monetary policy instruments shows that the interest rate, inflation and money supply all have individual positive relationships with economic growth.

Typical studies such as this, however, often do not go far as differentiating established economies and developing countries (Huang and Wei, 2006), and as result of this flaw, we observed that central banks (or the relevant monetary governing institution) are misguided and adopt inflation targeting (IT) as its main monetary policy goal. This really is a misguided but widely spread belief that economic policies, irrespective of prevailing economic development status of countries, will deliver the same result.

In this study, after the introduction and literature review, objectives and significance of this study are defined. Following research methodology and theoretical sections, monetary policy instruments are explained. In methodology, data and analytical framework, Augmented Dickey Fuller (ADF) unit root test, OLS, residual analysis, diagnosis test of the OLS model, normality Test, Breusch-Pagan-Godfrey heteroscedasticity test, stability test and, finally, conclusion and recommendations followed.

Literature review

Generally, many developing countries are characterized by weak institutions and financial underdevelopment which ensure that the effectiveness, transmission and implication of policy differ from those of advanced countries (Ghatak and Sánchez-Fung, 2007). This invariably means that monetary policy consideration should first and foremost be based on the level of development in the economy.

The adoption of IT by Malaysia as its primary monetary policy is also justified by the results of this study. The Bank Negara Malaysia (BNM) has constantly adopted 2.5-3.5 percent inflation annually. As the results show, inflation exerts the strongest influence on the level of economic growth in the country. This means that it should continually be controlled As Datta and Mukhopadhyay (2011) mentioned, a major objective for any country is to maintain a high level of economic growth with low inflation.

The realization of macroeconomic goals and objectives are dependent on stable economic growth, price stability, low unemployment and a stable balance of payments, which are important policies for every country. Delic and Kragulj (2005) revealed that, in order to attain these goals, several macroeconomic instruments are used, of which fiscal policy, monetary policy, income and price policies and international economic policy become important factors in economic performance. Sanni *et al.* (2012), however, demonstrated that the two principal policy instruments in achieving all the aforementioned objectives are fiscal policy and monetary policy. This study focuses on work that has been conducted by previous researchers and various academicians in this field, and aims to contribute to the existing literature and data. Ullah *et al.* (2013) assumed that inflation, exchange rates and

external reserves are important tools that can be used for boosting the economy, and there is a long-run relationship between these monetary instruments and economic growth. In his research, Alavinasab (2016) found that there is a significant long-run influence on economic growth by money supply, exchange rate and inflation. In another investigation, it was indicated that instruments, such as money supply, exchange rate determination and repo rate, are insignificant monetary policies (Chipote and Makhetha-Kosi, 2014).

Ogunmuyiwa and Ekone (2010) determined that money supply is positively related to GDP growth, although it is insignificant. In 2005, Ibrahim estimated that the real effects of monetary policy shocks are of considerable importance. Munir *et al.* (2009) found that there is a statistically significant positive relationship between inflation and growth.

Introduction of study: objectives and significance

This study investigates the relationship between monetary policy and economic growth in the light of a developing economy, with the main focus on Malaysia. Primarily, the research will concentrate on the interactions between interest rates, inflation, money supply and growth in GDP, which will serve as the instrument for measuring economic growth.

In other to achieve this primary goal, the following secondary objectives will be considered:

- to differentiate monetary policies and their respective effect(s) on the economic growth of developing economies;
- to identify the significant monetary instrument that is important for growth in developing countries; and
- based on the findings, to state which monetary policy adjustment is most appropriate for a developed economy in order for it to maintain a constant growth path.

The significance of monetary policy as the most important economic tool used by central governments cannot be overstated. A more in-depth understanding of how these policies can be influential can be highly beneficial. Therefore, this study can be advantageous in various ways. It will provide an objective perspective of the effectiveness of monetary policy in Malaysia, which is a developing country, and this in-depth understanding of the Malaysian economy can help other similar countries in the formulation of their own policies. The Malaysian economy has indeed improved significantly in the past 20 years. The poverty head count ratio at the national poverty line dropped from 5.7 percent in 2004 to 0.6 percent in 2014, while the gross national income per capita was $2,370 (current US$) in 1990, but increased to $11,120 (current US$) in 2014 (World Bank stat.).

This research investigates monetary policy application and its instruments for stabilizing an economy on a development path, such as in Malaysia.

Research methodology

The research will apply quantitative analysis to determine the impact of monetary policy on GDP and economic growth in the light of monetary policy instruments, particularly interest rate, money supply and level of inflation. Given the advancement and achievement in econometric analysis and computer software creation, the least squares estimates analysis will be used to investigate the relationship and significance between these variables.

Due to the availability of data, the scope of the analysis will be annual series data. All data used will be examined to ensure they are stationary in order to clarify and justify the use of the chosen econometric analysis.

Theoretic application

The quantity theory of money (QTM), in both its classical and neo-classical forms, provides the theoretical basis for this research. This is one of the most important economic theories

and has been refined, amended and elaborated by John Locke (1695), David Hume (1752) and Richard Cantillon (2010/1755), and later integrated into orthodox monetary tradition; it also forms the basis of the classical monetary theory. The QTM equation is defined by the below formula:

$$P = \frac{VM}{Y}$$

where V = velocity of money; Y = real output; M = money; and P = price.

If this equation is expressed in percentage change (growth rates), the QTM is expressed as:

$$p = v + m - y$$

where p = inflation rate; y = output; v = velocity of money; and m = money stock.

Over time, different contributions have affected QTM, including the neo-classical contribution for mathematical applications, such as Irving Fisher's famous equation of exchange and the celebrated Cambridge cash balance equation.

Fisher's equation of exchange is represented by the following:

$$MV = PT$$

where M = money supply; V = velocity of circulation; P = price level; and T = physical volume of market transactions.

The Cambridge cash balance equation is:

$$M = kPy$$

where M = stock of money; k = cash balance ratio (ratio of nominal money supply to nominal income); P = price level of income; and y = real national income.

The other contributions by neo-classical economists toward the QTM have emphasized the non-neutrality of money, an issue that was completely ignored in the classical QTM, and demonstrate that monetary control can be achieved in a fractional reserve banking system via an exogenously determined stock of high-powered money.

Neo-classical growth theory

The neo-classical growth theory places emphasis on capital accumulation and the decision to save as a significantly important determinant for economic growth. In the neo-classical growth theory parlance, the Solow growth model is usually the focal point of reference. In the Solow model, long-run growth of output per capita depends solely on technological progress. However, short-run growth can be the result of technological progress or capital accumulation. Solow (1956) adopted a direct expression on the constituents of the economic growth, based on the equation below:

$$\frac{\dot{Y}(t)}{Y(t)} = \frac{\dot{L}(t)}{L(t)} = \alpha_l(t)\left[\frac{\dot{K}(t)}{K(t)} - \frac{\dot{L}(t)}{L(t)}\right] + R(t)$$

where Y represents output, L represents labor, K represents capital and the term $R(t)$ is called the "Solow residual" All exponents in the equation above represent growth rates of the variable. The above equation indicates the transmission mechanism in which the variables can impact the economic growth of a country. It is clear from the above that growth under the Solow model is a function of growth of capital, labor and the Solow residual. The Solow residual is also referred to as total factor productivity, which is regarded as the index of technological progress.

Although the equation shows how the variables affect economic growth, it does not fundamentally identify the way in which monetary policy affects economic growth. Mundell (1963), however, proposed a comprehensible mechanism linking inflation and output growth. Mundell's model shows that a rise in inflation or inflation mechanism will cause people's wealth to dwindle. This is due to the fact that the return rate on individuals' real money balance falls. As such, in order to accumulate the desired wealth, people will save more by switching their assets, increasing their price and, thus, driving interest rates down. Conclusively, in Mundell's view, more savings equals greater capital accumulation and thus faster output growth.

Tobin's (1965) improvement on Mundell's model asserted that individuals would switch present consumption for consumption in the future by either holding money or acquiring capital. The Tobin effect, in other words, maintains that inflation causes individuals to substitute money for interest earning assets, which leads to increased capital accumulation and fosters economic growth.

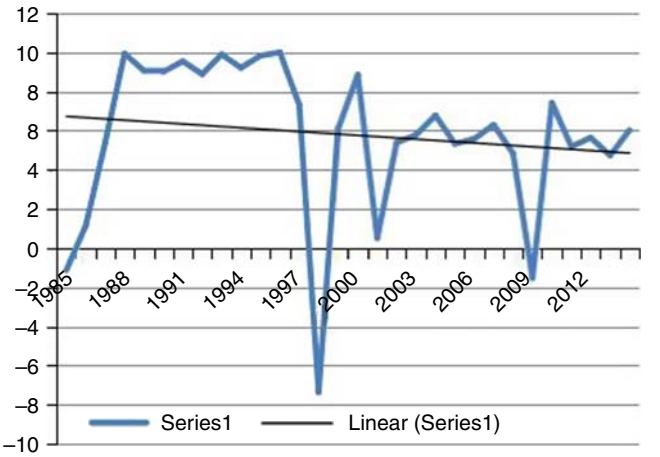
Endogenous growth model

Also known as the new growth theory, the endogenous growth model extends the classical theory by making rate of the technological progress or the rate of population growth both endogenous. In the monetary framework of the endogenous growth model developed by Lucas (1988) and Greiner (2013), the rate of inflation lowers the return on both capital and economic growth. Nevertheless, some representations of the endogenous growth model have revealed that inflation rate effects are insignificant.

Economic growth in Malaysia

The general consensus is that an increase in GDP over a period of time is, amongst other indicators, an acceptable parameter for measuring economic growth, and an upward movement trend in GDP is usually perceived as growth in the economy. However, with the availability of an indicator for GDP growth rate readily available, it is viable to employ the GDP growth rate as the variable for economic growth.

Figure 1 illustrates the time trend for economic growth rate over the selected period between 1985 and 2014. The GDP of Malaysia consistently demonstrated a positive growth



Source: Computed by researchers using data from the World Bank

Figure 1.
Trend of GDP growth rate

rate, except for 1998 when it decreased to a negative, which was caused by the Malaysian financial crisis that occurred in that year. Additionally, in 2009, the global financial crisis impacted the Malaysian economy and this was reflected in the negative GDP growth rate.

Monetary policy instruments

These are the variables that serve as the monetary policy instruments where their outcomes are used to cross-examine the performance of the economy in terms of their impact on growth.

Inflation

In this study, the annual inflation GDP deflator of Malaysia is used to represent the inflation parameter.

The relationship between inflation and economic growth has attracted significant interest in both theoretical and empirical studies. Nevertheless, it is notable that there is still no straightforward explanation for the nature of the relationship between inflation and economic growth. While the general consensus is that a high inflation rate will hinder economic growth, some scholars have argued that the effects of inflation on economic growth can be neutral or even positive, depending on how low the inflation is.

Interest rate

Fisher (1930) stated that the bridge or link between income and capital is the rate of interest. The adjustment of the interest rate is a major monetary policy instrument consistent with most central banks, and the BNM is no exception. The real interest rate of Malaysia is used in this study.

Money supply

The total amount of money in circulation is money supply; for this survey, M1 is cash and checking deposits, and M2, which covers M1 and saving deposits, money market securities and mutual funds, is considered. However, the money supply growth (M2) has been chosen as the monetary policy instrument. This is because it is the responsibility of the BNM to determine the amount of money in circulation, and their regulation of the money supply is evident through its growth.

The general consensus is that an increase in money supply leads to an increase in economic growth.

Figure 2 shows the time trend for inflation, interest rate and the money supply growth, which are the monetary policy instruments examined in this study. It can be observed that, during the period from 1990 to 1998, the money supply growth was erratic; however, since the Malaysian financial crisis, there has been consistency amongst the majority of the monetary policy instruments.

Methodology, data and analytical framework. Time series analysis involving the unit root test, Granger causality test, serial correlation test and other tests will be employed in this study. The unstructured OLS and ADF unit root tests are employed in the study.

From empirical analysis, the vector autoregressive (VAR) model appears to be the most commonly used for analysis of monetary policy; however, as Bliss and Gul (2012) stated, this methodology has the advantage of averting the need for a complete model specification for the whole economy, as when the effects of monetary policy actions are to be evaluated, the fundamental identification process must be solved.

Data used in this study are taken from the World Bank, where it is possible to obtain data from the Malaysian Department of Statistics and also the BNM, which is the central bank of Malaysia.

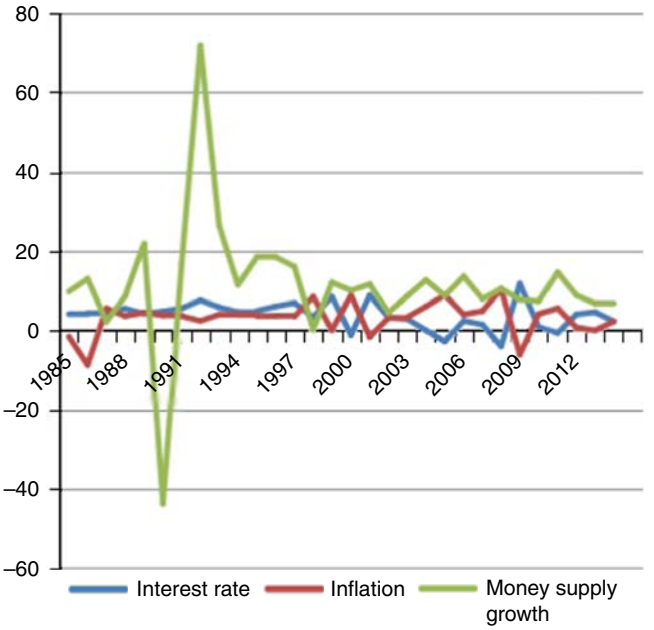


Figure 2.
Trend of monetary policy instruments

Source: Computed by researchers using data from the World Bank

Unit root test

It is vital that the unit root tests are applied before estimation to examine whether the variables are stationary or not. There are various methods for testing the stationarity of data. However, the ADF test will be used in this study.

ADF unit root test

The ADF unit root test proposed by Sjö (2008) is specified in the equation below:

$$\Delta x_t = \alpha_0 + \pi x_{t-1} + \varepsilon_t$$

Sjö (2008) emphasized that the null hypothesis $\hat{\pi}$ will be negatively biased in a limited sample; thus, it is only required to use a one-sided test for determination. H0: $\pi = 0 (x_t \sim I(1))$ against Ha: $\pi < 0$. $(x_t \sim I(0))$. This model is less restricted because it allows a deterministic trend as $x_t = \alpha t + \pi x_{t-1} + \varepsilon_t$.

Model specification

The objective of this study is to examine the effect of monetary policy on economic growth, taking into consideration the method of OLS. The advantages and limitations of this model have been highlighted in the introduction of this chapter.

Following the analysis of Bliss and Gul (2012), the model is specified; thus:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \mu_t$$

where Y = GDP, growth rate; X_1 = inflation; X_2 = interest rate; X_3 = money supply growth; and μ_t = error term or control variable.

In essence:

$$GDP = \beta_0 + \beta_1 inf + \beta_2 int + \beta_3 ms + \mu_t$$

Empirical application: unit root test

This section presents the results for the unit root test. There are various types of unit root test; however, the one chosen for the purpose of this analysis is the ADF test. Table I presents the results of the ADF unit root tests for all the variables used in the model, and it reveals that all variables are stationary at level. As a result, conversion or transformations of the data are not required.

The ADF test results presented in Table I demonstrate that all variables are stationary at level.

As already stated in an earlier section of this paper, analysis can only be conducted with the variables if, and only if, they possess a unit root. It is also important for the researcher to determine the level at which all variables possess a unit root before selecting the appropriate test to be used. In this case, the variables are all stationary at level, and therefore it is possible to select the OLS for this analysis.

In the unit root test – for which the ADF is considered – the results observed show that GDP values were not significant and were not affected by the independent variables between 1985 and 2014. The estimated ADF test results, which are higher than the test critical values, also show the relationship between the dependent variable GDP and the independent variables inflation, interest rate and money supply. According to the ADF test results, the estimated GDP value was −4.437979, which becomes stationary for the first differentiation at 1 percent. Considering the independent variables, the inflation rate estimated value was −6.085581 and it becomes stationary for the first differentiation at 1 percent. Similarly, the estimated money supply value was −4.927073 and it becomes stationary for the first differentiation at 1 percent. The estimated results indicate that the OLS results can be considered for the selected sample period (see Table I).

The test for the overall significance of the model, also called the test for good fit, was conducted using the probability of the *F*-test statistics. The probability value of 0.000003 is less than the error margin of 0.05 or 5 percent, allowed in the estimation of the model parameters (see Tables VII and IV). Based on this evidence, it can be inferred that this model is appropriate for determining the economic growth in Malaysia. Thus, the selected monetary instruments are of good fit, acceptable and desirable for measuring economic growth in Malaysia.

Variable	ADF-stat	Critical value	Prob*
GDP growth	−4.437979	−3.67*	0.0015
		−2.967767**	
		−2.622989***	
Inflation	−6.085581	−3.679322*	0.0000
		−2.967767**	
		−2.622989***	
Interest rate	−5.814342	−3.679322*	0.0000
		−2.967767**	
		−2.622989***	
Money supply	−4.927073	−3.679322*	0.0004
		−2.967767**	
		−2.622989***	

Note: *,**,***Denote 1, 5 and 10 percent critical levels, respectively
Source: Estimated by author

Table I.
Unit root test based on ADF

Econometric analysis

Before considering the model, the result of the effect of each independent variable to the dependent variable is summarized in Table II.

The estimated R^2 value for inflation is 0.0898549; for interest rate, it is estimated as 0.008039; and for money supply, it is estimated as 0.0035705 in the OLS, which are low and are assumed to have less effects on affecting the economic growth in this phase of estimation for Malaysia (see Table II). However, correct estimation of the considered parameters is required to add the dummy variables into the considered estimations. The OLS model was diagnosed for the necessary requirements, such as the normality test, autocorrelation test, heteroscedasticity test and stability test. All necessary tests were passed, and, as such, valid inference can be made based on the results of the model.

After considering the variables' individual effects, the analysis is now shifted to considering the model of this research, as already specified. It can, however, be noted that inflation and money supply were both positive, while interest rate had a negative singular contribution to GDP growth in Malaysia during the investigated time period.

The results from the OLS estimates are presented in Table III. However, before the results can be interpreted, it is necessary to analyze the residuals to determine that they are stable, normally distributed and that there is no presence of autocorrelation or heteroskedasticity. Therefore, residual analysis is performed in the next section.

The test for significance of the model, which is also the test for determination of the model, was conducted using the R^2 statistics and the adjusted R^2, which is considered to be a more effective and less biased test for determination because it considers the population size. The value 0.70 implies that 70 percent of variations or changes in the level of economic growth in Malaysia can be explained by the instruments of monetary policy used in the

Period	R^2	Constant	t	t–1
Independent variable: inflation				
t	0.0898549	4.847130 (5.316411)	0.298579 (1.658572)	–
Independent variable: interest rate				
t	0.008039	6.200059 (5.477854)	−0.106052 (−0.47639)	–
Independent variable: money supply growth				
t	0.0035705	5.254964 (5.820405)	0.046884 (1.018210)	–

Notes: Method: least-squares; dependent variable: GDP_GROWTH; sample (adjusted): 1985-2014; included observations: 30
Source: Estimated by author

Table II. Effects of the independent variables (inflation, interest rate and money supply) on the dependent variable GDP growth in Malaysia

Variables	Coefficients	t-statistic	Prob
Inflation	0.42	1.706241	0.0999
Interest rate	0.19	0.656487	0.5173
Money supply	0.046	1.011556	0.3211
Constant	3.19	1.680162	0.1049
R^2	0.15	–	–
F-stat	1.48	–	–
Prob (F-stat)	0.24	–	–

Notes: Method: least-squares; dependent variable: GDP_GROWTH; included observations: 30; sample: 1985-2014

Table III. Econometric results

study, which are inflation, interest rate and money supply (see Table IV). The same interpretation can be extended to the adjusted R^2 statistics.

The fitted OLS regression model reveals that a positive relationship exists between economic growth in Malaysia and all selected monetary instruments, namely, inflation, money supply and interest rates. The results show that inflation will cause the economy to grow by 769,643 (app. 0.77), while interest rates will cause the economy to grow by 472,013 (app. 0.47) and money supply will affect the economy positively by 15,803 (app. 0.2) (see Table IV). The significance of the estimated parameters was examined using the probability value. The inflation and interest rates were 0.0001 and 0.0165, respectively (see Table IV), which means that they are significant because the values were below the margin of error of 5 percent allowed in the model specification. Money supply growth was 0.5787 (see Table IV), which is above the margin of error allowed in the model; therefore, money supply was found to be insignificant.

Residual analysis

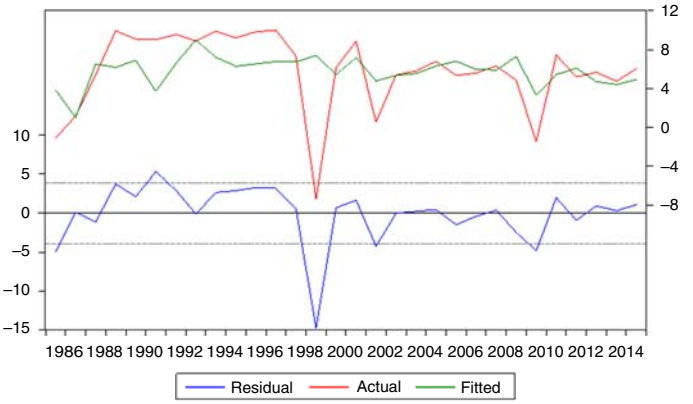
Figure 3 shows the residual distribution graph. From the figure, it is observed that there was a large skewness in the residual at 1998. This skewness, if not corrected, will render the analysis ineffective. There are various ways to correct this defect, which include:

- log transformation; and
- introduction of a dummy variable, etc.

Variable	Coefficients	*t*-statistic	Prob
Inflation	0.77	4.873815	0.0001
Interest rate	0.47	2.571347	0.0165
Ms growth	0.02	0.562701	0.5787
Dum	−17.43	−6.757718	0.0000
C	1.94	1.665844	0.1082
R^2	0.70	–	–
Adjusted R^2	0.65	–	–
F-stat	14.44	–	–
Prob (*F*-stat)	0.000003	–	–

Notes: Method: least-squares; sample: 1985-2014; included observations: 30; dependent variable: GDP_GROWTH
Source: Estimated by author

Table IV. Econometric results (2)



Source: Estimated by author

Figure 3. Residual analysis

For the purpose of this research, a dummy variable will be introduced to capture the variation in 1998. In 1998, the domestic economy of Malaysia suffered from the financial crisis that impacted the Asian zone, which was caused by a speculative attack (Zakaria *et al.*, 2010). The researcher believes that this crisis is the reason for the large residual variation in this period and, as such, the introduction of a dummy variable to cover this period should resolve this problem. The result of the analysis after introducing the dummy variable is presented in Table IV.

As previously, the residual analysis will be conducted by first analyzing the residual graph. The new residual graph is presented in Figure 4.

The residuals are now better fitted. Therefore, the diagnosis test of the OLS model can be performed.

Diagnosis test of the OLS model: normality test

Here, the null hypothesis that the residuals are normally distributed is tested. It is extremely important that the residuals are normally distributed for the validity of the estimated statistics of the OLS model. Figure 5 shows the Jarque-Bera test results.

In the model, the null hypothesis is not rejected. This is because the probability value for the Jarque-Bera is greater than 5 percent, which means that the null hypothesis can be accepted and the residuals in the OLS model are normally distributed. It also demonstrates that the model is not incorrectly specified.

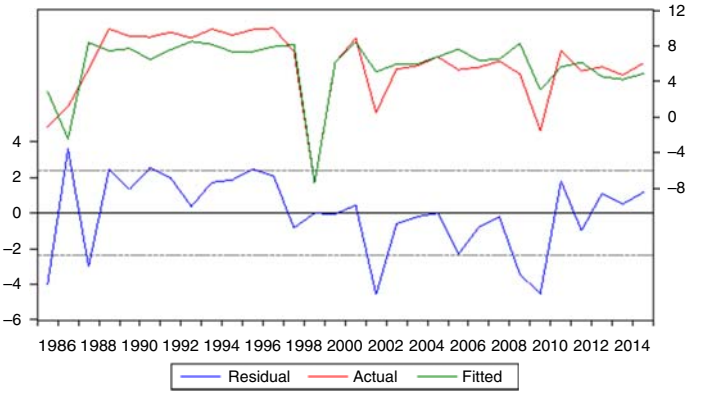


Figure 4.
Residual analysis (2)

Source: Estimated by author

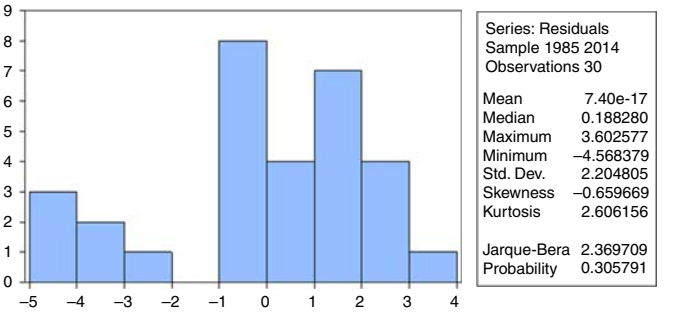


Figure 5.
Normality test table

Source: Estimated by author

Breusch-Godfrey serial correlation LM test

In testing for autocorrelation in the model, the Breusch-Godfrey serial correlation LM test will be used. Testing for autocorrelation in OLS residuals is conducted because the post-estimation analysis drawn from the model assumes that the residuals are not autocorrelated. The result of the autocorrelation test is presented below in Table V.

The null hypothesis is that there is no autocorrelation in the model. The results of the test above show that, even at four lags, the residuals are not autocorrelated. This is because the χ^2 probability value of the residuals at lag 4 is greater than 5 percent. Since the null hypothesis cannot be rejected, the model is not autocorrelated, which gives further credence to the specifications of the model.

Breusch-Pagan-Godfrey heteroscedasticity test

For the model to be valid as correctly specified, the residuals should be homoscedastic; that is, there should be no heteroscedasticity in the residuals. There are various heteroscedasticity regression tests available in the Eviews software; however, the Breusch-Pagan-Godfrey test has been chosen for this particular model. Although this was the chosen test in this case, the researcher verified the model using various other tests and the results were similar. Table VI shows the results of the heteroscedasticity test.

The null hypothesis is that the residuals in the model are homoscedastic, which is the desired situation for the model. From the result in Table VI, it can be observed that the χ^2 probability value of the observed R^2 is 0.07 or 7 percent. This is greater than 5 percent and, therefore, it can be inferred that there is no heteroscedasticity in the model and the null hypothesis can be accepted, which means that the residuals are homoscedastic.

Regarding to the estimated results from above estimations in tables following outcomes summarized. In Table II where estimated R^2 value for inflation is 0.0898549, for interest rate, it is estimated as 0.008039, and for money supply, it is estimated as 0.0035705 in the OLS; it is assumed that these parameters have less effects on economic growth. However when we consider the estimated parameters from Table III, it is observed that inflation (0.42) and money supply (0.046) have positive, whilst interest rate (0.19) had negative singular effects on growth in Malaysia; before the results are to be interpreted, the residuals test results are found stable and normally distributed, which implies that there is an autocorrelation to GDP in Malaysia.

After considering their individual effects, analysis is now shifted to considering the model of this research as already specified. It can however be noted that inflation and money supply are both positive while interest rate had a negative singular contribution to GDP growth in Malaysia. However, correct estimation of the considered parameters is required to add the dummy variables

Test stats	Coefficient
F-stat	1.30
Observed R^2	5.96
Prob $F(4, 21)$	0.3015
Prob χ^2 (4)	0.2021

Table V.
Breusch-godfrey serial correlation LM test table

Test stat	Coefficient	Prob
F-stat	2.531916	0.0656
Observed R^2	8.649307	0.0705
Scaled explained SS	4.823659	0.3056

Table VI.
Breusch-Pagan-Godfrey heteroscedasticity test

into the considered estimations. The OLS model was diagnosed for the necessary requirements, such as the normality test, autocorrelation test, heteroscedasticity test and stability test. All necessary tests were passed and, as such, valid inference can be made based on the results of the model. The final estimation of the R^2 and adjusted R^2 is also considered. The fitted OLS regression model reveals that a positive relationship exists between economic growth in Malaysia and all selected monetary instruments, namely, inflation, money supply and interest rates.

The results of the OLS analysis reveal that the monetary policy instruments used for the model demonstrate that monetary policy has a positive relationship with economic growth in Malaysia. A breakdown of the individual monetary policy instruments shows that the interest rate, inflation and money supply all have individual positive relationships with economic growth. The result of inflation having a positive relationship with economic growth is not out of theory. As Gokal and Hanif (2004) identified, even if the prices of goods in the economy have increased, output would not decline, as the producers has to fulfill the demand of consumers with whom the agreement was made. And continuation of economic growth is expected to lead further inflation which is not desired.

Stability test

For the results of the coefficients to be valid and considered to present a true representation of the model, they should be stable. If the coefficients are not stable, this means that the model is not well specified and, as such, the results of the coefficients may be incorrect. In order to verify the stability of the coefficients, the recursive coefficient test will be used. It is a simple graph test, the results of which are presented in Figure 6.

From Figure 6 above, it can be observed that all the coefficients fall between the level of significance; therefore, it can be inferred that the model is stable.

The results of the OLS analysis reveal that the monetary policy instruments used for the model demonstrate that monetary policy has a positive relationship with economic growth in Malaysia. A breakdown of the individual monetary policy instruments shows that the interest rate, inflation and money supply all have individual positive relationships with economic growth. The result of inflation having a positive relationship with economic growth is not out of theory. As Gokal and Hanif (2004) identified, even if the prices of goods in the economy have increased, output would not decline, as the producers has to fulfill the demand of consumers with whom the agreement was made. And continuation of economic growth is expected to lead further inflation which is not desired.

Conclusion

The analysis started by conducting the unit root test, which is required in order to select the methodology to be used for the model. The unit root test revealed that all parameters selected were stationary at level and, because of this, data transformation was not required. This also indicated that a simple regression analysis could be used, hence the OLS estimates were selected.

The results of the OLS model in Table II revealed significantly low R^2 and adjusted R^2 values. Additionally, none of the estimators were significant. However, analysis of the residuals demonstrated that the 1998 financial crisis that occurred in the Malaysian economy and the Asian region as a whole had significantly affected the result. Consequently, in order to capture this period of the crisis, a dummy variable was introduced (see Table IV and Table VII).

After the introduction of the dummy variable, the results of the new model shown in Table VII gave the following statistics.

Findings and interpretation of results

Fitting this result into the model specified earlier:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \mu_t$$

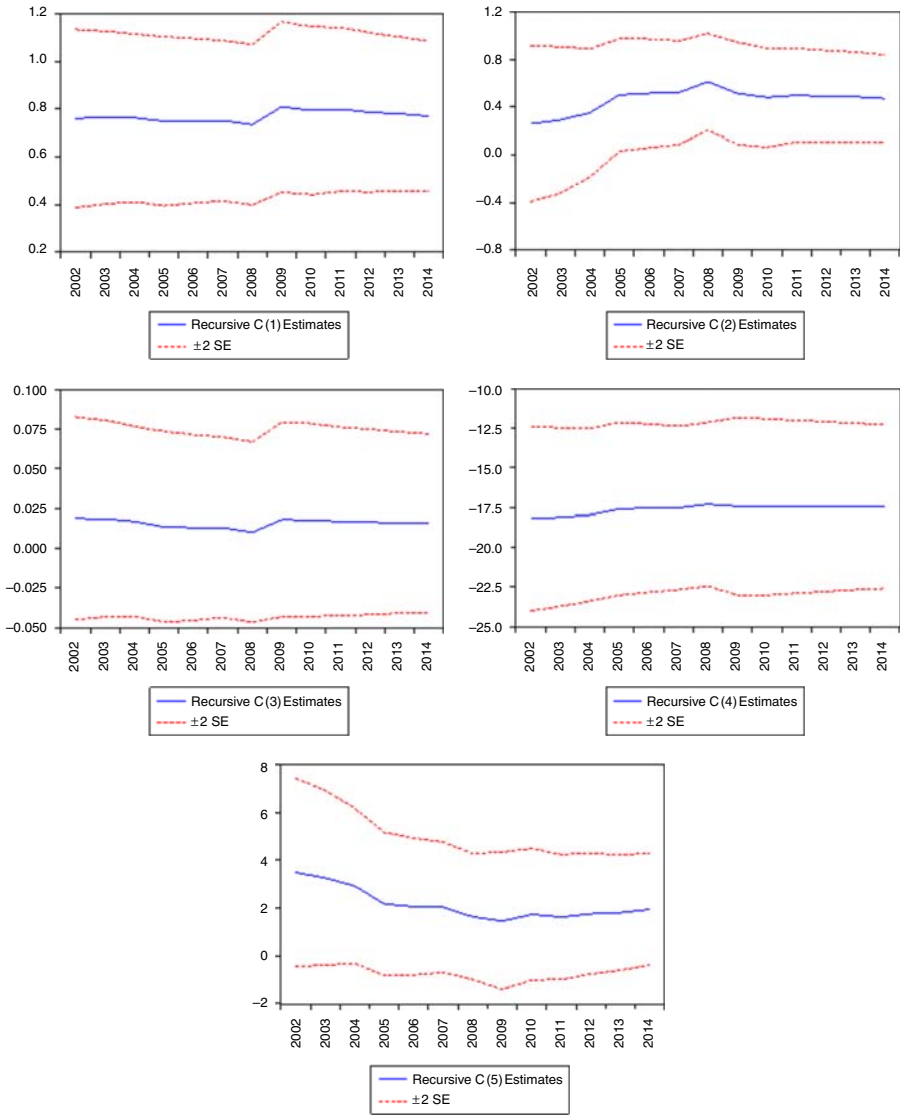


Figure 6.
Stability test

Thus:

$$Y = 1.94 + 0.77INF + 0.47INT + 0.02MS + \mu_t$$

It can be noted that the relationship between economic growth and inflation is positive. This entails that a 1 percent change in inflation will result in a 77 percent increase in the level of economic growth in this economy (see Table IV). While this may appear unreasonable based on the conventional wisdom that inflation usually affects the economy in a negative way, the relationship between economic growth and inflation has always been unpredictable. As Gokal and Hanif (2004) indicated, the prices of goods and services can increase and output will not decline, which can make inflation exhibit a positive relationship with economic growth.

Table VII.
Model result table

Variable	Coefficients
Inflation	0.77
Interest rate	0.47
Ms growth	0.02
Dum	−17.43
C	1.94
R^2	0.70
Adjusted R^2	0.65
F-stat	14.44
Prob (F-stat)	0.000003

Moreover, continuous economic growth is expected to lead inflation because as the standard of living increases, people are expected to have more income that they can spend on goods and services, which in the short run will lead to inflation. The positive relationship between inflation and economic growth is also supported by the study conducted by Gul *et al.* (2012). The study by Munir *et al.* (2009) on Malaysian economic growth and inflation showed that there was a positive relationship between inflation and economic growth in the country.

The linkage between economic growth and interest rates has also been observed to be positive. This translates into a one unit increase in money supply, resulting in the economic growth of the country increasing by 42 percent (see Tables III and IV). This finding is reinforced by the study done by Chandranath (2008), who found a similar relationship while measuring interest rates and economic growth in Sri Lanka.

The effects of monetary policy on economic growth is also supported by the study investigated by Yien *et al.* (2017), who found that interest rate observed to granger caused growth per capita, money supply, inflation, unemployment and foreign direct investment. In this investigation, bidirectional causality between unemployment and growth per capita is also demonstrated, which is parallel to the Mohd Noor *et al.*'s (2007) investigation as in this study suggested. However, in Lim *et al.*, it was suggested that Malaysia requires to elevate foreign direct investment in term of expanding growth per capita, which is supported with VAR granger causality estimations.

Finally, a positive nexus can be observed between economic growth and money supply. The coefficient value of 0.02 for money supply growth shows that it has the smallest effect on economic growth amongst the variables tested in the model. A one unit increase in money supply growth will exert a 2 percent increase on the economic growth of the country (see Table IV). This positive relationship is in line with the theoretical assertions of the classical QTM. It has also received empirical support in the studies by Nouri and Samimi (2011) and that of Ogunmuyiwa and Ekone (2010).

Observations from the test for economic or theoretical significance are based on the signs of the parameters. It was observed that inflation, interest rates and money supply all have a positive relationship with economic growth, which is in line with the a priori expectations. This means that monetary policy has positively affected the economic growth. This result is in line with Nibeza (2015), Kamaan and Nyamongo (2014), Sulaiman and Migiro (2014) and Gul *et al.* (2012) who also found in their various empirical studies that a positive relationship existed between monetary policy and economic growth. However, it is contrary to the empirical findings by Hameed and Ume (2011) and Chipote and Makhetha-Kosi (2014), whose studies revealed disparities in the magnitude of the effects that interest rates and money supply can have on economic growth in a country.

The results of the OLS analysis reveal that the monetary policy instruments used for the model demonstrated that monetary policy has a positive relationship with economic growth in Malaysia. A breakdown of the individual monetary policy instruments shows that the interest

rate, inflation and money supply all have individual positive relationships with economic growth. The result of inflation having a positive relationship with economic growth is not out of theory. As Gokal and Hanif (2004) stated, the prices of goods and services can increase and output will not decline, which can make inflation exhibit a positive relationship with economic growth.

There are also some studies which differ from this study. According to Hussain (2011) and Ramli (2012), they did not find any sign of causality between inflation and growth. According to them, there are no signs of causality from money supply to price level and from inflation to GDP and output.

Another major finding of this study is the devastating effect of the 1998 Asian zone financial crisis on the domestic economy of Malaysia. This effect was captured by the dummy variable in the model, which reveals a 17 percent negative effect on the economic growth of the country (see Table IV). This is indicative of the level of integration the economy of Malaysia has with other economies, particularly those in the same geographical region. This is in fact one of the usual arguments against globalization. The fact remains that, while no economy can survive independently, particularly in this era of globalization, some measures should be implemented in order to reduce the negative effects, which could range from imported inflation to a complete breakdown of economic institutions, as was observed in the most recent global recession in 2009.

Malaysia adopting IT as its major monetary policy is also justified by the results of this study. The BNM has constantly adopted a 2.5-3.5 percent inflation annually. As the results revealed, inflation exerts the strongest influence on the level of economic growth in the country. This means that it should continually be monitored and controlled. As Datta and Mukhopadhyay (2011) mentioned, a major objective for any country is to maintain a high level of economic growth with low inflation.

Recommendations and policy implications

Based on the findings of this study, the following recommendations can be made, which could serve as policy instruments for Malaysian economic development. This does not mean that the findings can be generalized for other developing economies. Attempts to significantly reduce inflation can actually adversely affect the Malaysian economy. However, attempts to accelerate the economy by increasing the level of inflation may cause the Malaysian economy to overheat and push the inflation rate to an unstable level. Consequently, the Malaysian economy is fundamentally in a precarious situation unless policy instruments which are affected by inflationary measures are not changed.

The results of this research give rise to various issues, one of which is that money supply growth does not explain a large portion of the economic development in Malaysia. It is widely acknowledged that the primary monetary policy of the principal monetary organization in the country, the Malaysia BNM, and indeed many other central banks is price stability in the form of low inflation rates. The reason behind this can be found in this research, as it can be observed that inflation has had the largest contribution to the economic development in Malaysia over the studied period. Over the past two decades, Malaysia has maintained a single digit inflation rate, and this has significantly contributed to the development of the country's economy, which can be a valuable lesson for other developing countries.

The results also suggest that monetary stability can contribute toward price stability. This is because variations in price levels are predominantly caused by money supply, as argued by Milton Friedman, who stated that inflation is always a monetary phenomenon, regardless of the country (Friedman, 1970).

The dummy variable, which captured the Asian crisis in 1998, showed the devastating effect on the domestic economy of Malaysia, which suggests that the economy of Malaysia is closely integrated with the global economy and is vulnerable to external shocks. The researcher recommends that, while still relying on market forces, demand management

policies should be restrictive in order to achieve stability and a level of domestic dependence, thereby reducing the susceptibility of the domestic economy to external shocks.

Although monetary policy instruments are essential in influencing changes in prices, output and economic development, it is still necessary for the central bank to embark on comprehensive monitoring of monetary aggregates. For example, policy implementation can focus on controlling and manipulating short-term interest rates in the form of prime lending rates as well as the treasury bills rate as a major tool for transmitting monetary impulses for the economic performance of the domestic economy. The researcher propounds that monetary authorities should focus their efforts on increasing the influence of money supply growth on the economic growth of the country. Money supply is a particularly important tool because of its flexibility and the ease at which monetary authorities can manipulate it to fit the prevalent economic situation.

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