Asian Journal of Agricultural Extension, Economics & Sociology
3(6): 473-487, 2014; Article no. AJAEES.2014.6.001

SCIENCEDOMAIN *international*
www.sciencedomain.org

Monetary Instruments and Inflation: Econometric Analysis Based on Malaysia Economy

Abdul Rahim Ridzuan[1*], Maizatul Saadiah[1], Maimunah Ismail[2], Abdul Halim Mohd Noor[2] and Elsadig Musa Ahmed[3]

[1]Department of Economic, Faculty of Business Management, Universiti Teknologi MARA, Malacca City Campus, Malaysia.
[2]Department of Economic, Faculty of Business Management, Universiti Teknologi MARA, Alor Gajah Campus, Malaysia.
[3]Economic Unit, Faculty of Business and Law, University Multimedia, Malacca Campus, Malaysia.

Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

Original Research Article

Received 28th March 2014
Accepted 21st May 2014
Published 16th June 2014

ABSTRACT

The relationship between inflation and monetary policy is widely discussed in the research paper. The increase in inflation is seen as an indicator of a country's constant growth. However, it is crucial for the government to keep the country's inflation under control by adopting the right policies such as monetary policy. This paper is assessing the impact of monetary instrument in controlling inflation rates in Malaysia over the period of 1970 to 2010. The analysis begins by testing the unit root test to determine the stationarity of the data. All the variables are found to have a long run relationship based on the Johansan Juselius cointegration test. From the causality test, it was also found that there is an existence of unidirectional causality for all variables of CPI, interest, reserve and money supply for Malaysia. The findings of this paper have some handy proposals that should help the policymaker to develop a plan of action for the development of this nation. First, the authority must constantly monitor the level of reserve requirement in the country.

**Corresponding author: E-mail: aimaz84@yahoo.com;*

Second, the authority needs to control the amount of money supply in order to control money volume in the market to reduce the excess demand of goods and services. Third, the central bank needs to monitor the level of interest rate closely in order to control the inflation problem in the country.

Keywords: Infaltion; monetary policy; johansen juselius cointegration test; Inflation.

1. INTRODUCTION

Macroeconomics has long argued and prioritized on the issue of the interaction between inflation and economy. Inflation is seen to have a negative effect for the benefit of the long term growth. Study in literature has yet to have a definitive answer to the exact relationship between inflation and growth. In addition, the manner of the link between inflation and economic growth has become a popular issue in research. According to [1], evidence of the relationship is varied based on the variation between the school of taught. This is exemplified by the two opposing thoughts which are the structuralist that supports inflation for economic growth while the monetarist that rejects inflation because they believe that inflation can hurt the growth of the economy. Based on the economic view, inflation rate refers to the increase of the general prices on the goods and services in countries over a period of time. The increase will cause the same value of money will obtain fewer goods and services as inflation increases. To conclude, higher inflation in the country will result in the low purchasing power, higher cost of living, and low quality of life. Monetarists believe and agree that high inflation rate is due to excessive growth of money supply of the country. The Keynesian point of view however, has considered that the quick growth of the economy has led to immeasurable demand in the country that eventually leads to an increase in inflation. [2,3] suggest that high or hyper-inflation will retard economic growth, although there could be a positive relationship between inflation and economic growth when the inflation rate is low. Inflation may have a negative impact on economic growth through the investment channel. Many countries have used the contractionary monetary policy instead of using contractionary fiscal policy to curb their inflation problem.

2. BACKGROUND OF THE STUDIES

Table 1 shows the percentage of gross domestic product (GDP) and percentage of inflation in Malaysia from 1991 to 2000. Overall, the highest inflation rate recorded in Malaysia was 5.3 in 1998 and it achieved the lowest at 2.5% in 1999. The average growth rate in Malaysia during the period is about 8%.

The diagram shows the level of inflation (CPI), deposit rate (I), money supply (MS) and reserve requirement (RS) between 1970 up to 2010. The inflation rate in Malaysia was recorded at 1.50% in February of 2013 as reported by the Department Statistics of Malaysia. Historically from 1970 until 2010, Malaysia rate has averaged from 3.65 percent to the highest of 23.90% in March of 1974 and a record low of -2.40 percent in July of 2009. In Malaysia the most important categories in the consumer price index (CPI) are food and non-alcoholic beverages (30% of total weight) followed by housing, water, electricity, gas and others fuels (23% of total weight). Others items include transport (15%); communication (6 percent); recreation and culture (5%) and furnishing, household equipment and routine household maintenance (4%). The remaining components are restaurant and hotels at (3.2%) and miscellaneous goods and services at 6.3%. The level of money supply and

reserve requirement shows a similar tend where both facing increasing trend throughout the years except a sharp fall during early 1990s.

Table 1. Growth rate in GDP and inflation for Malaysia, 1990-2000

Year	%GDP	%Inflation
1991	9.5	3.0
1992	8.9	5.1
1993	9.9	3.3
1994	9.2	3.8
1995	9.8	3.4
1996	10.0	3.3
1997	7.3	3.1
1998	-7.4	5.3
1999	6.1	2.5
2000	8.3	2.7

Source: Figure calculated from BNM quarterly economic bulletin

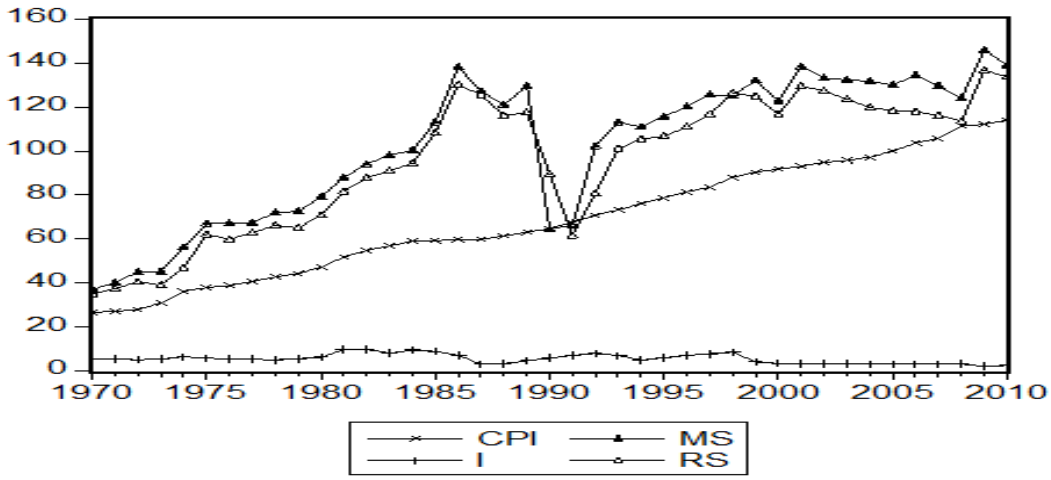


Diagram 1. CPI, I, MR and RS

Undeniably monetary policy has played a major role in maintaining this low inflation, and this supports the conditions for high rate of real output growth. These conditions did not persist over an extended period as shown during the 1998th episode of financial crisis that brought severe turmoil to Malaysia, with massive depreciation of local currency and had caused a sharp increase in domestic price. Prior to the mid-1990s, the monetary policy strategy had been implemented based on targeting monetary aggregates (M1, M2 or M3). Government first started to focus on targeting with M1 and shift its focus to M3 when the financial liberalization and innovation has rendered M1 to be less reliable for policy targeting. Evidence proves that velocities of M1 and M3 and their average values over the last ten year have diverged from their long trend. Even though M2 showed divergent trend, the divergence is comparatively smaller than M3. Thus, we employ M2 as monetary targets to examine its efficiency in attaining the stability of output growth and low1 inflation rate.

This paper intends to explore the most significant policy instruments under monetary policy that can be used to control the level of inflation in Malaysia. This study implements extensive series of econometric testing to justify the finding of the research.

3. LITERATURE REVIEW

Earlier studies on detecting the relationship between inflation and economic growth by [2,3] suggest that hyper-inflation is able to retard economic growth, but when the inflation rate is low, there could be a positive relationship between inflation and economic growth. Inflation may have a negative impact on economic growth through the investment channel [4]. Find that an increase in inflation or expected inflation will increase the domestic nominal interest rate and reduce the attractiveness of new investment projects that in return, do not generate high enough returns. Thus, high inflation will increase uncertainty about the future returns from investments [5], on the other hand have found that an increase in the growth rate in India have led to the decline in inflation rate rather than the opposite. The study is a contrast from the finding of [6] who found that inflation in Pakistan is driven by the growth in the country.

The factors contributed to inflation should be investigated in order for the policy maker to develop something beneficial to their nation. In this case, we try to list down all the factors. There are interest rates, interbank and TB discount rate that were proven by [7], monetary growth or money supply by [8]; and interest rate and exchange rate by [9,7] see the movement in the nominal interest rate in the ASEAN-5 region tends to be correlated with the movement in inflation rate. Besides that, the correlation between interbank rate and TB discount rate, the two series during the period where both series are available are very high on 97 per cent [8]. On the other hand, have found that monetary growth (M3) is shown to be positively and highly correlated with inflation [9]. Find the evidence that policy interest rate does not have influence on inflation as it is decoupled from the market rate and does not affect financial decisions of economic agents and the supply of credit. This result contradicts to the exchange rate where it has strong impact on prices with a large degree of dollarization.

Monetary policy plays a key role in managing economic fluctuations. Most past studies have to identify which instruments in monetary policy that influenced the inflation. Studies done by [10] find the significant relationships between money and real income or separately with prices. Their result has indicated the cointegration of real income and real money with the effect of interest rates and concluded that M1 aggregate statistically does have the predictive power over income. In addition [11], have proven the evidence of causality between money (M2) and output in the post-liberalization, money dominated credit. As compared to [12], they find M1 and M3 appear to have significant effect on output and prices using VECM but not in M2. Besides [13], find that the monetary policy is credible to fight inflation [7]. Observe that the behaviour in monetary policy conducted in Thailand, Malaysia and the Philippines does not appear to change significantly while in the case of Indonesia, it significantly shifts in the conduct of monetary policy. In the same line, fiscal policy can also be used to cater the inflation problem.

The study of literature has shown that the empirical study on Malaysia regarding the relationship between money supply and aggregate prices or inflation is limited and has failed to settle on a definitive answer. One study by [14] analyze the causal relationship between growth rate of money supply and inflation rate in Malaysia. The data used in the study was from the period of 1970:1 to 1992:4. In this study, it was found that a unidirectional causality

runs from money supply to inflation rate and it does not depend on the lag structure. Another study by [15], is done to examine the causality direction between money supply and aggregate prices in the Southeast Asia economies (i.e. Malaysia, the Philippines, Singapore and Thailand). In this study, the Granger causality test, modified Sims causality test and vector error-correction modelling (VECM) approach were utilized in the study. Regarding Malaysia, the study has found that all causality tests are consistently implied that money supply (M1 and M2) Granger causes aggregate prices. The findings on this study agrees with earlier study done by [16,17].

Another study by [12], is done to investigate the dynamic linkages between money, output, interest rate and prices in Malaysia. The study employed monthly data from 1975 to 1995 and used the Johansen's cointegration test and vector error-correction modelling approach. The study has produced an interesting result in which in the short run, the causal effect runs from money supply to aggregate prices. However, the study has also found that there is no evidence of reverse causality. The study concluded that monetary policy can serve as an alternative to reach price stability in Malaysia [18]. Utilizes the relatively new causality testing procedure developed by [19] –modified Wald (MWALD) test in order to re-investigate the causal relationship between money supply and aggregate prices in Malaysia. In this study, the sample period was gathered from the quarterly data from 1970 to 1998. By utilizing the MWALD test, it shows that money supply (M2) leads aggregate prices in Malaysia. However, the study by [20] has shown aggregate prices do not Granger cause money supply. Another view offered in the study by [21] suggest that money supply and aggregate prices in Malaysia do not Granger cause each other.

A study by [22] has used the Johansen's cointegration test and VECM approach in order to examine the the long run equilibrium relationship and the causality direction between inflation and its determinants (i.e. money supply, output, interest rate, exchange rate and trade balance) in Malaysia. The result in this study has shown that the variables are cointegrated but there is an absence of evidence that shows direct causal effect runs from money supply to inflation in Malaysia. The study concluded that based on the findings, inflation rate in Malaysia is significantly influenced by external forces such as the ASEAN 1 inflation rate and exchange rate. The recent study by [23], concluded that the effect of money supply (M1) on inflation in Malaysia is negative and statistically significant at 1 per cent level. The finding of this study rejected the monetarists' view that inflation that sees inflation is due to excessive rate of expansion of money supply.

4. METHODOLOGY

The model proposed for this paper is modified from the study carried out by [24,18]. The suggested model is as followed:-

$$CPI = f(MS, RS, I)$$

The level of aggregate price (CPI) can be influenced by the level of interest rate (I), money supply (MS) and the reserve requirement (RS).

We then transform the model into log form:

$$LNCPI = \beta_0 + \beta_1 LNMSt + \beta_2 LNRS_t + \beta_3 LNI_t + \varepsilon_t$$

It is expected that:-

β_1 is expected to be positive
β_2 and β_3 are expected to be negative

Money supply, β_1 is the amount of fiat money circulated in the economy. It has positive relationship with the level of inflation in the country. Higher amount of money supply means more money are circulated in the country lead to more consumption or investment activities and therefore lead to higher demand for more goods and services. This excess demand of goods and services lead to higher inflation.

Reserve requirement, β_2 is expected to have negative relationship with the level of inflation, CPI. Reserve requirement is referred to an amount of interest that commercial bank needed to deposit into central bank account for each deposit received from the public. Lowering the reserve requirement lead to higher excess reserve, this refers to the amount of loan that the commercial bank can use to borrow to their potential customer. This will also lead to higher spending activities and higher level of inflation in the country.

Interest rate, β_3 is expected to have negative relationship with the level of inflation, CPI. For example, when the country's interest rate is high, it will lead to higher cost of borrowing. Higher cost of borrowing will reduce the people's desire to loan more for consumption or investment activities. This will reduce the excess demand for goods and services and lead to a lower inflation rate in the country.

The tests that we run using this model are:-

4.1 Unit Root Test

The general idea of unit root test is to test whether each variable has stationary or non stationary properties in time series analysis. It is important to identify the unit root properties to avoid spurious estimation in the model (error term not normally distributed with means not zero and variance is not constant. To understand further about unit root test, this study started with

$$Y_t = \rho Y_{t-1} + \mu_t$$

Where: $-1 < \rho < 1$ and μ_t is white noise error term. If the ρ value = 1, it means there is an existence of unit root (non stationary). To solve this problem, previous lag value was added and subtracted with Y_{t-1} and we get:

$$Y_t - Y_{t-1} = (\rho - 1) Y_{t-1} + \mu_t \text{ and simplified to}$$

$$\Delta Y_t = \delta Y_{t-1} + \mu_t$$

Where: Δ is first difference and $\delta = (\rho - 1)$ (δY_{t-1} = stationary, μ_t = non stationary). It means when $\delta = 0$, $\rho = 1$, Y_t is non stationary. The hypotheses can be generated as followed (applied on ADF and PP test):

Ho: Non stationary (δ=0, ρ=1) $\Delta Y_t = \mu_t$

H_1: Stationary (δ<0 or δ=-1 ρ=0), $\Delta Y_t + \delta Y_{t-1} = \mu_t$.

4.2 Johansen Juselius Cointegration Test

After all data contain no unit root problem, the cointegration test can be run. The general idea about cointegration test is to know the long-run relationship between variables. If there is cointegration, there will be a stable long-run equilibrium in the model and all variables move together to single equilibrium. This study must find at least one cointegration factor before we proceed with VECM.

Johansen test uses two test statistics which are Trace and Max-Eigen Value. The models of this test are:

Trace Statistic

$$\lambda_{TRACE}(r) = -T\sum \ln(I - \lambda_t)$$

Maximum-Eigen Value

$$\lambda_{\max}(r,r+1) = -T\sum \ln(1 - \lambda_{I-I})$$

Where:

λ_I = characteristic roots estimates value found from matrix Π
r = Cointegration factor
T = observation

This test was using 1% and 5% significant level and the hypotheses are:

Ho: There has no cointegration (have no long run relationship in the model)
H_1: There has cointegration (have long run relationship in the model)

If both test statistic (Trace and Max Eigen Value) is more than critical values (1% or 5% significant level) it will reject Ho means there has cointegration for at least with one factor (exist long-run relationship).

4.3 Vector Error Correction Model (VECM)

The VECM is used to investigate the short-run relationship in the models. VECM stands for Multi Error Correction Models, which means the models are larger than one. VECM is used to investigate dynamic relationship and it is used together with Granger Causality analysis. The purpose of using VECM in this study is to know if there exists single stable equilibrium or not (error correction term is diverge or converge).

For easy understanding, VECM is a dynamic model because for each time period, if there are any forces that disequilibrium the model, the error term will always try to achieve its equilibrium again in the previous time period. This model is called Error Correction Model because an error term is always trying to correct the model to single stable equilibrium.

4.4 Granger Causality Test

Granger Causality test is used to know the specific correlation between variables in the model. It means Granger is a test for each variable whether if it is correlated or causes causality to other variables. If both variables are causing each other, it means that the model is a good. But it also depends on the study and hypotheses.

H_0: $\alpha = 0$ (non-Granger Causality)
H_1: $\alpha \neq 0$ (Granger Causality)

The rejection or acceptance of the hypothesis is determined by comparing the F-statistical value with the F-critical value. If the F-statistical value is greater than the F-critical value at certain level, hence H_0 will be rejected thus the parameter is significant. Granger Causality test with VECM framework need to be applied because this research intends to know what causes, direction and influence the relationship among the variables in the model.

4.5 Impulse Response Function (IRF) and Variance Decomposition (VDC)

Variance decomposition (VDC) can be described as causality test outside the estimation period. VDC decomposes variations in an endogenous variable in the VAR. It shows the percentage of forecast error variance for each variable that may be attributed to its own shocks and to fluctuations in the other variables in the system. IRF on the other hand measures the predictable responses to a standard deviation shock to one of the system's variables on other variables in the system.

The main aim of this paper is to detect the relationship between monetary instruments and inflation. The results also can be used to help policymaker to make a better decision making to curb inflation problem in Malaysia.

5. SOURCES OF DATA

The data for the variables used in this paper is obtained from World Development Indicator 2011 International Monetary Fund statistical database and Bank Negara Malaysia annual report. This paper used annual data starting from 1970 up to 2010 with 41 number of observation. CPI data used is based on 2005, deposit interest rate (%) is used as a proxy for interest rate, M2 is used to represent money supply while a liquid liability to GDP (%) is used to represent reserve requirement.

6. EMPIRICAL RESULTS

The first step of the analysis was to test the stationary of the data. The variables that were used in the model were tested with Dickey Fuller/Augmented Dickey Fuller (DF/ADF) and Phillip Perron (PP) unit root test. The result of the test is shown in Table 2. Based on table 2, it was found that found that the variables are not stationary at level but stationary between 1% to 5% significance level after first difference except for LNCPI, which is shown to be not stationary at first difference for no trend. In this study, it is required for the variables to stationary at first difference to enable Johansen Juselius cointegration test to run in this study. Based on the previous statement, another test was used which is the Phillip Perron (PP) test was used to retest the stationarity of the data. This test was chosen because it is more powerful unit test compared to the first test that was employed earlier. After the retest,

it was found that more weight was given to the Phillips-Perron unit root test. This showed that this test is more reliable as the test has shown the presence of large amounts of heteroscedasticity. The characteristics of the PP unit root test introduced by [25] that proposes a nonparametric system of controlling for higher-order serial correlation in a series is seen as an advantage in this study. All the data is found to be non stationary at level but stationary only after the first difference. Therefore, it fulfils the requirement to precede the analysis with Johansen-Juselius cointegration test (JJ).

6.1 Johansen-juselius Cointegration Test

The optimum lag is detected through residual for each variables used in the model. The optimum lag is detected by making sure that all the residual probability must be larger than 5% significant level in order to avoid autocorrelation problem. The process will begin from the lowest lag, up to the point that all the variables residual is greater than 5% significant level. Here, lag 2 was detected as the optimum lag for the study. By following max-eigen value statistics from Table 3, it indicates the existence of at least 3 cointegrating vector between the variables where the null hyphothesis ($r \leq 2$) is rejected at 5% significant level. Since there is more than one cointegrating vector, the analysis using VECM and granger causality test was preceded.

Table 2. Unit root test

Country	DF/ADF unit root test			
Malaysia	**Level**		**First difference**	
	No Trend	**With trend**	**No trend**	**With trend**
LNCPI	-1.953 (9)	-3.169 (1)	-1.179 (6)	-3.688 (8)**
LNI	-1.524 (0)	-3.046 (1)	-5.215 (0)***	-5.190 (0)***
LNMS	-2.462 (0)	-2.823 (0)	-5.743 (1)***	-5.969 (1)***
LNRS	-2.337 (0)	-2.682 (1)	-5.273 (1)***	-5.567 (1)***

Note: (*),(**),(***) indicate significant at 10%,5% and 1% significant level respectively. Number in bracket represents number of lag. The test used Schwarz Info Criterion.

Country	PP unit root test			
Malaysia	**Level**		**First difference**	
	No trend	**With trend**	**No trend**	**With trend**
LNCPI	-4.092 (7)	-1.969 (9)	-3.614 (0)***	-4.431 (2)***
LNI	-1.555 (4)	-2.240 (5)	-5.700 (12)***	-6.963 (14)***
LNMS	-2.821 (6)	-2.195 (6)	-5.507 (1)***	-5.955 (4)***
LNRS	-2.468 (5)	-2.281 (3)	-4.988 (3)***	-5.135 (6)***

Note: (*),(**),(***) indicate significant at 10%,5% and 1% significant level respectively. Number in bracket represents number of lag. The test used Schwarz Info Criterion

6.2 VECM Model

The VECM model from Table 4 shows that all the variables have corrected sign and supported orthodox school of monetarist that CPI, has negative correlation with interest rate (I) and reserve (RS) has positive relationship with money supply (MS). To be more specific, 1% increase in MS lead to 0.54% increase in CPI. The evidence was consistent with the past finding of [8] and [9] as they found out that broad money growth or money supply is found to be highly significant in determining inflation in both the short and long terms of inflation, especially in the long run. Besides, 1% increase in I and RS will lead to the

reduction of CPI by 0.419% and 1.639% decrease respectively. Here, it can be concluded that RS gave the highest impact to inflation (CPI) followed by MS and I.

Table 3. Johansen-juselius cointegration test

Hypotheses	Eigen value	Trace statistic	Critical value (5%)	Max-Eigen value	Critical value (5%)
Ho : r = 0	0.654	73.630**	47.856	40.428**	27.584
Ho : r ≤ 1	0.473	33.202*	29.797	24.365*	21.131
Ho : r ≤ 2	0.206	8.836	15.494	15.780*	14.264
Ho : r ≤ 3	0.001	0.055	3.841	0.055	3.841

*Note: Lags=2 are determining after testing with Correlogram test and it is free from autocorrelation problem (testing with each variables residual). r indicates the number hypotheses of cointegration factor (r=0 means 1 cointegration, r=2 means at least two cointegration factor). *means 5% and ** means 1% significant level (α). Data also using SIC criterion*

Table 4. Vector error correction model

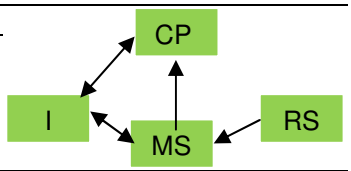
$LCPI_t = 2.921 - 0.419LI_t + 0.541LMS_t - 1.639LRS_t + \mu$
Orthodox monetarist state that Interest (LI) has –ve correlation, Money Supply (MS) +ve and Reserve (RS) has –ve relation to inflation.

6.3 Granger Causality Test

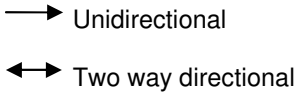
Result of Granger causality can be viewed in Table 5. To summarize, MS has bidirectional relationship with CPI, RS has bidirectional with MS. Given that MS is the causes of the aggregate prices (CPI), it therefore supports monetarist view where monetary policy will be the effective price stability instruction. MS and I have two way relationships besides CPI and I. The granger causality test is detected by following F-statistic. The negative value of ECT_{t-1} has proven that all the variables will converge in the long run. To simplify, if there is any change in CPI value (dependent variable), it will narrow down the gap value in the model, which means in the long run there will only exist single stable equilibrium point. So this is the proof of the strong relationship between inflation (CPI) with other variables (MS and RS) and weak relationship with I.

Table 5. VECM granger causality test and diagram

Dependent Variables	Granger Causality Chi-square statistic (probabilistic)				$VECM_{t-1}$ Value (t-statistic)	Causality Diagram
	D(CPI)	D(LI)	D(LMS)	D(LRS)	ECT^{t-1}	
D(CPI)	-	3.156	2.212	0.872		
D(LI)	2.422	-	4.812	9.689	-0.071	
D(LMS)	0.369	15.849	-	1.875		
D(LRS)	1.085	2.801	7.501	-		



Note: $VECM_{t-1}$ is value to determine the short run relationship. This value is important because if significant, changing in independent variables will affect widening or narrowing the dependent variables. ECT_{t-1} is Error Correction Term, where CPI = inflation, I= interest, MS = Money Supply, RS = reserve and L = Pure logarithm. This test also using 10% significant level. The granger causality test is based on F-statistic.



6.4 Impulse Response Function

Following Fig. 1, most of the responses from one variable to another variable is a temporary shock (the straight line coming back to mean) except for CPI to CPI and CPI to MS where it shows a permanent shock (the straight line does not move to mean).

As an alternative check, dynamic simulations are used to calculate VDC and visualize the IRF in order to corroborate the result obtained through VECM. An analysis of the IRF is presented in Diagram 2. A ten-period horizon is employed to allow the dynamics of the system to work out. Shocks to variables in particular to LNI have an impact on LNCPI, LNRS, LNI and LNMS. Besides, LNRS also has significant shock towards LNCPI, LNMS, LNI and LNRS as the line decreased throughout the horizon and seem to be significant and persistent. The shock can also be detected between LNMS and LNCPI, LNI, LNRS and LMS. Weak shock is detected between LNCPI towards LNI, LNRS and LNCPI except for LNMS. Therefore, the IRF appears to be almost consistent with the earlier VECM results.

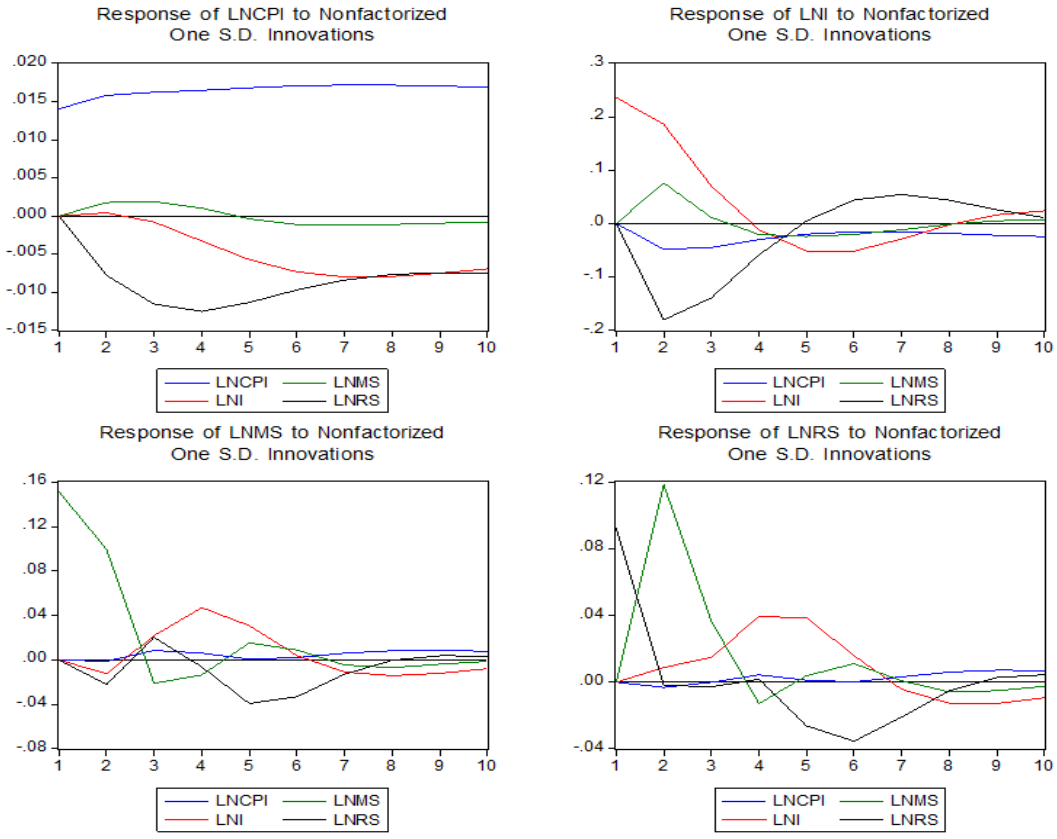


Diagram 2. Impulse response function of one standard deviation shocks/innovations

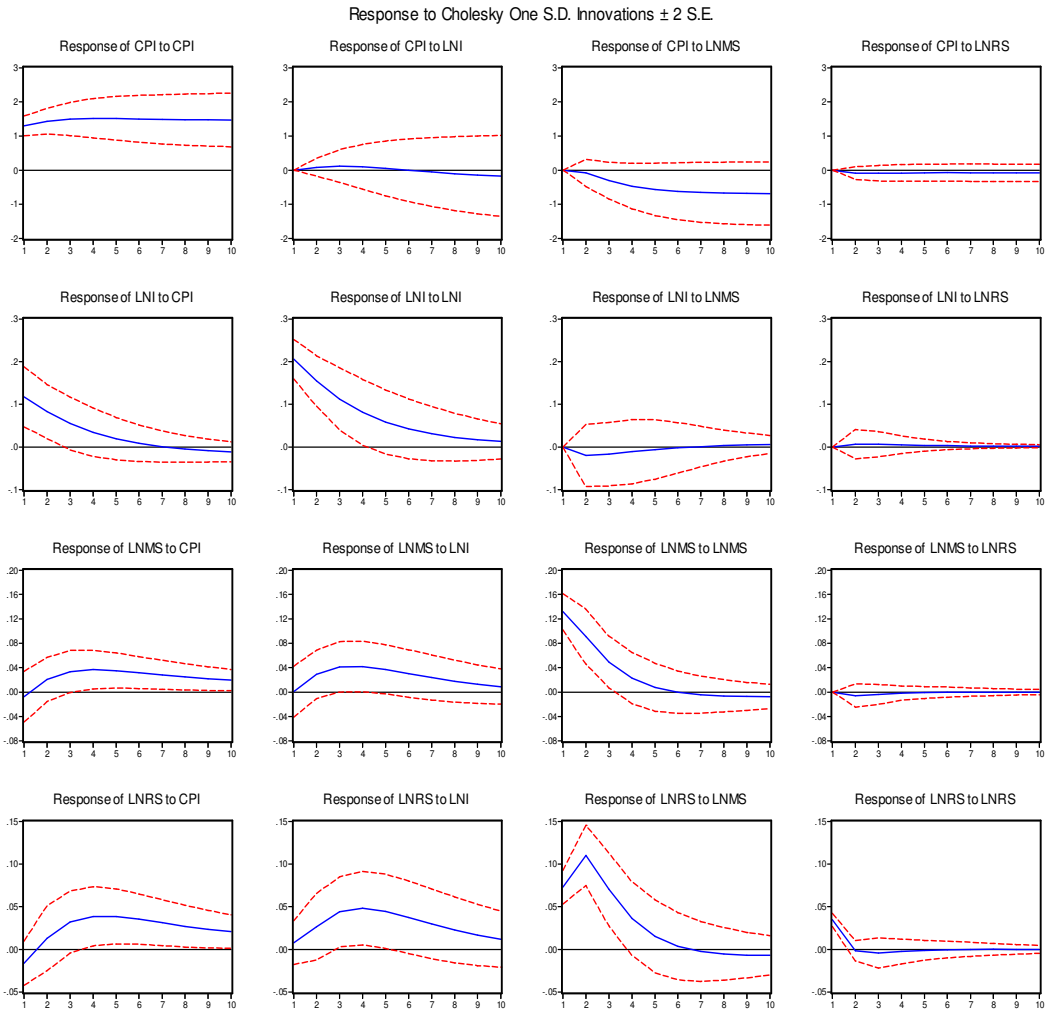


Fig. 1. Impulse response function

6.5 Variance Decomposition

The result of VDC is reported in Table 6. A ten-period horizon is employed to convey a sense of the dynamics of the system. The Granger-causal chain implied by the analysis of VDC tends to suggest that RS is the relatively endogenous since it has the lowest percent 19.03% (at year 10) compared to MS, CPI and I. I is relatively exogenous because the percentage change seems small from 82.69% in period 1 to 76.62% in period 10. 76.62% of the variance can be explained by itself (exogenous). I is a leading variable in this case, followed by CPI, MS and RS. Decomposition of CPI, besides being explained by its own variables, CPI can be explained by I. The same can be said for I, in addition to be explained by the variable itself, it is explained by variable CPI.

Table 6. Variance decomposition

Variance Decomposition of LNCPI:				
Period	**LNCPI**	**LNI**	**LNMS**	**LNRS**
1	100.0000	0.000000	0.000000	0.000000
2	91.51510	0.005638	4.183008	1.594359
3	82.04942	0.085786	8.276825	2.783205
4	74.44853	0.691821	11.46135	3.380206
5	68.68582	1.858276	13.47601	3.494344
6	63.97206	3.248747	14.37545	3.402071
7	59.75034	4.535881	14.58608	3.259707
8	55.82491	5.519748	14.50111	3.123955
9	52.09478	6.162760	14.34398	3.014835
10	48.59602	6.541359	14.21384	2.937368
Variance Decomposition of LNI:				
Period	**LNCPI**	**LNI**	**LNMS**	**LNRS**
1	16.08376	82.69043	0.000000	0.000000
2	14.80494	79.46786	6.273997	4.924559
3	13.30550	79.30939	14.81151	6.582813
4	12.76404	79.74061	18.04320	6.710850
5	13.43565	78.95106	17.80914	6.519361
6	14.64942	77.90181	17.37663	6.495981
7	15.65492	77.18652	17.70393	6.616249
8	16.24821	76.80226	18.24022	6.688787
9	16.54645	76.65672	18.52063	6.677812
10	16.71254	76.62082	18.55102	6.636551
Variance Decomposition of LNMS:				
Period	**LNCPI**	**LNI**	**LNMS**	**LNRS**
1	6.175251	0.892644	91.49956	0.000000
2	6.452646	2.144009	72.91537	0.246496
3	7.007643	3.668436	58.30016	0.441028
4	9.111081	9.141648	46.39358	0.416134
5	10.24123	10.66009	39.06318	1.041383
6	10.56069	10.46195	35.10568	1.472961
7	10.60289	10.59582	32.35717	1.523352
8	10.59016	10.94374	29.92356	1.514333
9	10.57998	11.21558	27.71724	1.514540
10	10.59824	11.33208	25.80382	1.516722
Variance Decomposition of LNRS:				
Period	**LNCPI**	**LNI**	**LNMS**	**LNRS**
1	14.19175	0.000299	70.84519	56.87093
2	9.132829	0.045087	85.04189	32.86215
3	8.679683	0.488921	85.34591	29.02522
4	10.00912	5.922078	79.01844	25.09565
5	11.54899	9.874100	73.57826	21.41360
6	12.15588	10.14250	72.22435	19.86473
7	12.25395	10.04275	72.08447	19.33902
8	12.21722	10.37427	71.82355	19.14908
9	12.17572	10.75699	71.50522	19.06744
10	12.15851	10.96678	71.31776	19.03200

7. POLICY RECOMMENDATION AND CONCLUSION

This paper helps to clearly determine the best monetary instrument adopted by central bank of Malaysia used to control inflation in Malaysia. We have adopted more advanced econometric tests to forecast and evaluate further the contribution of each of the variables used in the model. Interest rate (I) is found to have negative relationship with consumer price index (CPI) that captures inflation. Higher interest rate means higher cost of borrowing and therefore reducing the intention of the people to borrow money to purchase goods and services. The reduction in excess demand for goods and services is able to control the level of inflation in the country. Besides, money supply, (MS) has a positive relationship with the inflation and thus has proven the quantity theory of money developed by Irving Fisher. The difference is we failed to find a proportional relationship between the MS and CPI. The last variable, reserve, (RS) or required reserve ratio is also found to have a negative relationship with CPI. Higher required reserve ratio means higher amount of share from each deposit enter into central bank, lowering the excess reserve and therefore lead to lower borrowing to the people and inflation level. In summary, this paper found that the best instruments that used under monetary policy to curb the problem of inflation in Malaysia are the reserve requirement, followed by money supply and interest rate. Central bank needs to carefully set up the amount of reserves requirement towards the commercial banks in order to control the amount of deposit or loan available to the public besides setting the right level of money supply and interest rate in the country.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Mallik G, Chowdhury A. Inflation and Economic Growth: Evidence from South Asian Countries. Asian Pacific Development Journal. 2001;8(1):123-135.
2. Fischer S. The Role of Macroeconomic Factors in Growth. Journal of Monetary Economics.1993;32:485-512.
3. Gregorio D Jose. Inflation, Taxation, and Long-Run Growth. Journal of Monetary Economic. 1993;31:271-298.
4. Taylor JB, Moosa I. Macroeconomics: Australian Edition. Brisbane; 2000.
5. Chatrath A, Ramchander S, Song F. Stock Price, Inflation and Output: Evidence from India. Applied Financial Economics. 1997;7:439-445.
6. Ahmed M Khalid. Economic Growth, Inflation, and Monetary Policy in Pakistan: Preliminary Empirical Estimates. The Pakistan Development Review. 2005;44(4)2:961–974.
7. Arief Ramayandi. Approximating Monetary Policy: Case Study for the ASEAN-5. Working Paper in Economics and Development Studies No. 200707; 2007.
8. Latifah Merican, Cheong. Globalisation and the operation of monetary policy in Malaysia. Derived. Bank Negara Malaysia publication. The Central Bank and the Financial System in Malaysia: A Decade of Change 1989-1999; 2004.
9. Fahad Alturki, Svetlana Vtyurina. Inflation in Tajikistan: Forecasting Analysis and Monetary Policy Challenges. IMF Working Paper WP/10/17. Middle East and Central Asia Department; 2010.
10. Friedman BM. Kuttner KN. Money, Income, Prices and Interest Rates. The American Economic Review. 1992;57(3)189-203:472-492.

11. Azali M. Matthews KGP. Money - Income and Credit – Income Relationships during the Pre-and Post-Liberalization Periods: Evidence from Malaysia. Applied Economics. 1996;3:1161-1170.
12. Tan HB, Baharumshah AZ. Dynamic Causal Chain of Money, Output, Interest rate and Prices in Malaysia: Evidence Based on Vector Error-Correction Modelling Analysis. International Economic Journal. 1999;13(1):103-12.
13. Mark Gertler, Jordi Gali, Richard Clarida. The Science of Monetary Policy: A New Keynesian Perspective. Journal of Economic Literature. 1997;37(4):1661-1707.
14. Abdullah AZ, Yusop Z. Money inflation and causality: The case of Malaysia (1970-92). The Asian Economic Review. 1996;38(1):44-51.
15. Masih AMM, Masih R. Does money cause prices, or the other way around? Multi-country econometric evidence including error-correction modelling from South-East Asia. Journal of Economic Studies. 1998;25(3):138-160.
16. Lee S, Li W. The lead-lag relationship of money, income and prices in Malaysia. Singapore Economic Review. 1985;28:73-87.
17. Tan KG, Cheng CS. The causal nexus of money, output and prices in Malaysia. Applied Economics. 1995;27:1245-1251.
18. Tang TC. Causality between money and price in Malaysia: A revisit. Labuan Bulletin of International Business & Finance. 2004;2(1):71-81.
19. Toda HY, Yamamoto T. Statistical inference in vector autoregressions with possibly integrated processes. Journal of Econometrics. 1995;66(1-2):225-250.
20. Karim ZA, Mokhtar A, Zaidi MAS. Dasar kewangan, sasaran matlamat pertengahan dan matlamat ekonomi. Jurnal Ekonomi Malaysia. 2001;35:13-35.
21. Pinga VEB, Nelson GC. Money, prices and causality: Monetarist versus structuralist explanations using pooled country evidence. Applied Economics. 2001;33(10):1271-1281.
22. Cheng MY, Tan HB. Inflation in Malaysia. International Journal of Social Economics. 2002;29(5):411-425.
23. Tang CF, Lean HH. Is the Phillips curve stable for Malaysia? New empirical evidence. Malaysian Journal of Economic Studies. 2007;44(2):95-105.
24. De Grauwe P, Polan M. Is Inflation Always and Everywhere a Monetary Phenomenon? Scandinavian Journal of Economics. 2005;107(2):239-259.
25. Phillips PCB, Perron P. Testing for a Unit Root in Time Series Regression. Biometrika. 1988;75(2):335–346.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid= 566&id=25&aid=4937