Investigating the Effects of Monetary and Fiscal Policy on economic Growth in ASEAN: A Threshold Modelling Approach

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In the economic theory, many arguments from the different school of thoughts have been raised to justify the efficiency of economic policy in the view of stabilization. For instance, the correlation between macroeconomic variables and economic performance is a contentious issue. In this paper, we carefully examine and compare the impacts of fiscal (government expenditure) versus monetary policy (broad money and real interest rate) on economic growth using nonlinear regression. In particular, the main objectives include (1) to model the nonlinear threshold effect of broad money in modelling the economic growth by considering the 1997 Asian financial crisis influences and (2) to compare the impacts of both policies on economic growth. The study is based on a panel of ASEAN5 countries for the period of 1995-2015. Panel threshold regression established by Hansen (1999) was employed. The results reported a single threshold effect of broad money on inflation before and after controlling the crisis on determining economic growth. Here we observed that monetary policy through real interest rate caused to lower GDP growth while broad money led to the trade-off between inflation and growth. When broad money is high (above the threshold value), it led to higher economic growth but was compensated with the trade-off cost of higher inflation. Also, the Asian financial crisis caused to the significant drop in economic growth in ASEAN5. Overall, the study reported inefficient fiscal policy and monetary policy in the case of ASEAN countries.

Keywords: economic growth; monetary policy; fiscal policy; threshold effects

I. INTRODUCTION

For ages, the question about the effectiveness of fiscal and monetary policy as a main tool of the economy has become popular among economists especially in the scientific research. Some school of thoughts believed that fiscal policies can have positive effects on the economic growth while for others, the economy is always in a good and balanced situation. On the other hand, fiscal policy will have no effect or detrimental the economy. In contrast, monetarists believed that by increasing the circulation of money it will help the economy momentum to be more vibrant and it will deter the sluggish economic condition.

Nevertheless, it is known that both policies can be coexisting in the economy by putting forward the nonlinear character of fiscal and monetary policy in the economy growth. While linear models have been widely used in empirical studies, however, specific issues of economic data remain unexplained. This is because the behaviour of many economic crises or incidents which vary quite dramatically. Brooks (2014) stated that the economic behaviour may either alters suddenly which is known as a structural break or may vary for a period of time before either it returns back to its original position or changes to another behaviour namely, as a regime switching. Recently, there has been a huge amount of interest of non-linear models. In particular, the regime switching, or state dependent variable model has become the most prominent.

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There are bulks of arguments regarding non-linear relationships between macroeconomic variables and economic growth. For example, Barro (1999) stated that the effect of highest government spending and taxation on the economic depends on the size of the government, suggesting a positive net effect if the government size is small. It indicates the existence of an optimal or growth maximizing level for the government size. Furthermore, some empirical studies proposed the non-linear correlation between the government size and economic growth portrayed as an inverted U-shaped curve or called Armey curve. The inverted U shaped was popularized by Armey (1995).

Motivated by these facts, this study examines generally the non-linear relationship between various macroeconomic variables and economic growth. In this study, we captured the threshold effects from monetary and fiscal variables on economic growth before and after controlling the 1998 financial crisis. Besides that, we compared the influences of fiscal versus monetary policy on determining the economic performance.

A. A Review on the Economies in ASEAN Countries

Historical data showed that ASEAN countries exhibiting high and stable GDP growth for about three decades (1970-1996) prior to the financial crisis of 1997-98. Table I shows that the during the period of 1970-1996, the highest annual growth rate of the developing countries in ASEAN were 7 percent. In 1998, most of the ASEAN countries went through recession after the crisis hit Thailand in 1997. The financial crisis affected four countries namely; Indonesia, Malaysia, the Philippines, and Thailand with the average rate of growth were -7.5 percent in 1998. Economic recession, especially in the crisis-affected countries experienced high inflation and rising of unemployment rate.

Table 1. GDP Growth rates in selected ASEAN countries (%)

Country	1970-1996	1996	1997	1998
Thailand	7.5	5.5	-1.3	-10.0
Indonesia	6.8	8.0	4.5	-13.7
Malaysia	7.4	8.6	7.5	-7.5
Philippines	3.6	5.8	5.2	-0.5
Singapore	8.2	7.6	8.4	0.4

II. LITERATURE REVIEW

Monetary and fiscal policies are the two important tools used by the government to control the macroeconomic trend. However, the drastic changes of economic indicators put pressure on policy makers to draw firm conclusions on the choices of monetary and fiscal policy. Furthermore, fiscal and monetary policies can have different impacts in determining the economic performance. Rather than focusing on the linear modelling, we apply the threshold approach to study the impacts of fiscal and monetary policies.

Wimanda (2011) investigates the effect of exchange rate depreciation and money growth to the consumer price index (CPI) inflation in Indonesia. A static panel threshold model was applied to estimate the Phillips curve equation. This study showed that there are threshold effects of money growth on inflation, but no threshold effect of exchange rate depreciation on inflation. The results reported that the threshold value for exchange rate depreciation is found to be 8.4 percent while the F- statistics suggests that there is no significant difference between the coefficient below and that above the threshold value. However, two threshold values were detected for money growth, which are 7.1 and 9.8 percent. The study revealed that the impact on inflation is high when money grows by up to 7.1 percent and moderate when money grows by 7.1 - 9.8 percent. However, inflation is low when money growth exceeded the threshold level of 9.8 percent.

In other study, Grawe and Polan (2005) examined the nonlinear relationship between money growth (M1 and M2) using panel data of 160 countries over the last 30 years. The sample was divided into four groups and the study concluded that the money growth-inflation relationship still holds. However, after splitting the sample for high inflation countries and low inflation countries, they showed that for the low inflation countries which are below 10 percent the relationship is weak. In contrast, a strong relationship is found for high inflation countries. However, this study did not determine the level of money growth that gives different impact on inflation.

Lee and Werner (2018) reported that interest rate is the main key policy for many countries. They claimed that lower interest rates result in higher growth while higher rates result in lower growth. This study examined the relationship between nominal GDP growth and two different benchmark rates such as 3-month and 10-year rate. The findings revealed that interest rates follow GDP growth and positively correlated with growth. In contrast, Ihsan and Anjum (2013)

analysed the relationships among GDP, interest rate, CPI and inflation rates by using regression analysis for Pakistan in the period of 2000- 2011. The study observed that CPI and interest rate had a significant impact on GDP and inflation rate. Mohammad *et. al.,* (2009) conducted studies to find out the long run relationship between M2, inflation, government expenditure impact   and economic growth in Pakistan. The results reported a negative relation between public expenditure and inflation where they claimed that most of the public expenditure is non-development and inflation is due to adverse supply shock or cost push inflation in case of Pakistan. Yan and Gong (2009) studied the effect of fiscal policy on economic growth. They claimed that the taxation structure and government expenditure would affect the long-run growth through three medium such as household's choice, saving-consumption choice and the percentage of government expenditure to GDP. They found that expenditure does not always have a positive effect on economic performance.

III.   MATERIALS AND METHOD

A.   Sources of Data

This study employs the panel data, consisting of the ASEAN-5 countries (Indonesia, Malaysia, Philippine, Singapore and Thailand) over the period of 1995 – 2015. The data were collected from the World Development Indicators of the World Bank and Federal Reserve Bank of St. Louis (FRED). The details of the data are presented in Table 2.

Table 2. Variables, symbols and measurements

Variables	Symbols	Measurements
Inflation	inf	log CPI– log CPI (t-1)
Economic growth	gdp	GDP percapital
Government expenditure	ge	% ofGDP
Broad money	bm	% ofGDP
Real interest rate	ri	%

B.   Econometric Methodology

Threshold regression models have developed rapidly over the three decades started with the seminal work of Tong (1983). Economic relationships may change subject to structural breaks or switching regimes. To handle this,

threshold regression models have been developed. However, due to the important issues of unknown structural breakpoint and asymmetric behaviour of variables in different regimes, econometricians recognized that in addition to time, other variables may cause a structural change that is called threshold variables. In this section we used Hansen (1999) to search multiple regimes in the data using broad money (BM) as a possible threshold variable. The advantage of Hansen methodology based on an asymptotic distribution. Since the data series are in panel form, we employ panel unit root test to determine whether the variables are stationary. Panel unit root tests were employed and tested. These tests are used to test the null hypothesis of unit root. After confirming that all variables are stationary, the threshold autoregressive model developed by Hansen (1999) is estimated. To test for the existence of a threshold effect of broad money on economic growth, the following model is estimated:

$$Y_{it} = \begin{cases} u_{it} + \theta' h_{it} + \alpha_1 d_{it} + \beta_1 C_{it} + \delta_1 K_{it} + \xi_{it} & , \quad d_{it} \leq \gamma_1 \\ u_{it} + \theta' h_{it} + \alpha_2 d_{it} + \beta_2 C_{it} + \delta_2 K_{it} + \xi_{it} & , \quad \gamma_1 < d_{it} \leq \gamma_2 \\ u_{it} + \theta' h_{it} + \alpha_3 d_{it} + \beta_3 C_{it} + \delta_3 K_{it} + \xi_{it} & , \quad \gamma_2 < d_{it} \end{cases}$$

$$(1)$$

$$\theta = (\theta_1, \theta_2, \theta_3)' \quad h_{it} = (GE_{it}, RI_{it}, BM_{it})$$

$$\xi_{it} \sim iid\,(0, \sigma^2)$$

where Y_{it} represents economic growth (GDP), d_{it} (broad money) is the threshold variable and h_{it} the explanatory variable, C is the 1998 financial crisis or dummy variable, K is the interaction effect between government expenditure and financial crisis, u_{it} is the fixed effect that represents the heterogeneity of countries under different policies and h_{it} are the explanatory variables which may affect economic performance. $\theta_1, \theta_2, \theta_3$ are the coefficient estimates of the explanatory variable (government expenditure, GE, real interest rate, RI and broad money), α_1 is the threshold coefficient when the threshold value $\leq \gamma_1$; α_2 is the threshold coefficient when the threshold value$>\gamma_1$ but $\leq \gamma_2$ and α_3 is the threshold coefficient when the threshold value $> \gamma_2$; $\beta_1, \beta_2, \beta_3$ represent the coefficient estimates of the dummy variable, C   while $\delta_1, \delta_2, \delta_3$ represent the coefficient estimates of the interaction effect, K. The error ξ_{it} are assumed to be independent, identically distributed

(i.i.d), with mean zero and finite variance $\sigma^2 (\xi_{it} \sim i.i.d.(0, \sigma^2))$, i represents different countries and t represents different periods. It is important to determine whether threshold effect is statistically significant or not. Hansen (1999) suggested a bootstrap to simulate the asymptotic distribution of threshold estimate. Using the two-stage ordinary least squares (OLS) method and minimizing the sum of squares of errors, $S_1(\gamma)$, the estimators of the threshold value and the residual variance $\hat{\gamma}$ and $\hat{\sigma}^2$ can be obtained. The null hypothesis of no threshold effect is tested, $H_0 : \alpha_1 = \alpha_2$, using the likelihood ratio test $F_1 = \dfrac{(S_0 - S_1(\hat{\gamma}))}{\hat{\sigma}^2}$ where S_0 and $S_1(\hat{\gamma})$ are sum of squared error for null hypothesis and alternative hypothesis, respectively. Since then F_1 has non-standard distribution, Hansen (1999) showed that bootstrap procedure will construct *p-values* and critical values that are asymptotically valid. When the alternative hypothesis holds, $H_1 : \alpha_1 \neq \alpha_2$ it shows that there is a threshold effect between broad money and economic growth. Thus, the asymptotic distribution of threshold estimate is tested with the null hypothesis, $H_0 : \gamma = \gamma_0$, using the likelihood ratio statistics test of $LR_1(\gamma) = (S_1(\gamma) - S_1(\hat{\gamma}))/\hat{\sigma}^2$. The asymptotic confidence interval is shown as $c(\alpha) = -2 \log (1 - \sqrt{1 - \alpha})$ where for a given asymptotic level α, the null hypothesis of $H_0 : \gamma = \gamma_0$ is rejected if $LR_1(\gamma)$ exceeds $c(\alpha)$.

IV.   RESULTS AND DISCUSSIONS

A.   Panel Unit Root Tests

Panel unit root tests in Table 3 shows that all variables are stationary at levels, I(0) since the nulls hypothesis of unit root were rejected at 1% level except for GE and BM which are rejected at 5% level of significance. This allows further analysis of the panel threshold regression.

Table 3. Panel unit root tests

Variables	t-stat	Level of integration
GDP	-6.32 (0.00)	I (0)
INF	-6.58 (0.00)	I (0)
BM	-2.19 (0.01)	I (0)
GE	-1.76 (0.04)	I (0)
RI	-6.86 (0.00)	I (0)

Note: The numbers in bracket represent p-values.

B.   Tests for Threshold Effects

Table 4 reports the results of F-statistics for single, double and triple threshold effects before and after the 1998 financial crisis together with their bootstrap p-values. We applied 300 bootstrap replications for ach three bootstrap tests. The statistics F1 which refer to the test for single threshold effect before controlling the crisis is significant at 5 per cent level since it is higher than the critical value of 14.487. However, the F statistics for double and triple threshold are insignificant with the bootstrap p-value 0.4433 and 0,2367 respectively. Similarly, after controlling the crisis, the results show that F-statistics for single threshold is significant at 1 per cent whilst for double and triple threshold are considered as statistically not significant at 10 per cent level. Hence, we conclude that there is evidence of a single threshold effect of broad money on economic growth conditioned by inflation before and after controlling the crisis. Henceforth, we focus on the single threshold model for the rest of the estimation results.

Table 4. Test for threshold effects before and after controlling the crisis

	Before controlling the crisis	After controlling the crisis
Test for single threshold		
F1	16.31	8.52
p-value	0.010**	0.007***
(10%,5%,1% critical values)	(8.12,10.01,14.49)	(5.41,6.49,7.60)
Test for double threshold		
F2	3.19	1.32
p-value	0.44	0.42

(10%,5%,1%	(7.41,9.77,14.87)	(8.57,10.40,13.61)
critical values)		
Test for three		
threshold		
F3	3.69	2.57
p-value	0.24	0.49
(10%,5%,1%	(10.98,15.92,24.78)	(8.57,10.40,13.61)
critical values)		

Note: The asterisks (***), (**) and (*) denote the statistically significant at 1%, 5% and 10% levels respectively.

Table 5. Threshold estimate for broad money before and after controlling the crisis

	Before controlling the crisis	**After controlling the crisis**
Estimate, γ_1	58.90	58.90
95% confident interval	[58.05;59.00]	[56.70;59.00]

It is shown in Table 5 that the estimated value of a single threshold before and after controlling the financial crisis is found to be 58.9 thus splitting all observation into two regimes.

A. Estimated Coefficient Single Threshold Models

Table 6 shows the result of the threshold estimation based on OLS standard errors before and after controlling 1998 crisis. The two coefficients of our main interest are those regression coefficients $\beta_{1\,1}, \beta_1, \beta_2$, by each regime. The first regime's estimated coefficient before controlling the crisis is 1.1105 which is not significant at 10 percent. We can also note that when the broad money is less than or equal to the threshold of 58.9, inflation rate has no significant effect on economic growth. In other words, there is no relationship between inflation and economic growth when the broad money below the threshold level. However, in the second regime, the estimated coefficient is 32.29 which is significant at 1 percent level. The results indicate that when broad money is above the threshold level, inflation has a positive significant effect on economic growth. Apart from that, we can see that the real interest rate has negative significant effect on GDP growth. This implies that 1 percent increase in interest rate leads to lower GDP growth by 0.14 unit. In contrast, government expenditure and broad money are insignificant which implies that there is no relationship between both variables and economic growth before considering financial crisis. The result shows that monetary policy is not effective which higher interest rate leads to lower GDP growth. However, GDP may still show an increment but with lower rate. After controlling the crisis, the real interest rate and broad money have negative significant effect on economic growth. This implies that 1 per cent increase in the real interest rate and broad money will lead to lower GDP growth. Our findings corroborate with the findings of several studies such as Adusei (2013) who found that money supply undermined economic growth.

Similarly, there is negative significant effect of dummy variables on economic growth which implies that during the crisis period (1997-98), economic growth is 8.77 units lower than the non-crisis period. On the other hand, crisis has caused to very large drop (-8.76 units) of GDP growth as compared to other macroeconomic variables. Our findings also reported no significant relationship between government expenditure and interaction (GE and crisis) with GDP growth. The dependent regimes switching shows that the first regime's estimated coefficient is -4.27 which is not significant at 10 percent. In other words, there is no relationship between inflation and economic growth when the broad money below the threshold level. However, in the second regime, the estimated coefficient is 17.18 which is significant at 1 percent. The results indicate that when broad money is above the threshold level, inflation has a positive significant effect on economic growth.

Table 6. Estimated coefficient single threshold model before and after controlling the crisis

	Regressors	Coefficients	Std. Errors	t-stats
Before	GE	0.05	0.25	0.18
	RI	-0.14	0.08	-1.79*
	BM	-0.05	0.03	0.11

	INF (BM ≤ 58.9)	1.11	5.94	0.19
		32.29	4.40	7.33**
	INF (58.9 < BM)			
After	GE	-0.03	0.22	0.13
	RI	-0.13	0.07	-1.86*
	BM	-0.05	0.03	-1.97**
	C	-8.77	1.67	-
	K	0.57	1.69	5.24***
				1.21
	INF (BM ≤ 58.9)	-4.27	5.29	-0.81
		17.18	5.29	3.25***
	INF (58.9 < BM)			

Note: The asterisks (***), (**) and (*) denote the statistically significant at 1%, 5% and 10% levels respectively.

V. SUMMARY

In this study, we focus our analysis on examining and comparing the impacts of fiscal policy versus monetary policy on economic growth using nonlinear regression. Applying the threshold regression analysis, we detected a single threshold estimate before and after controlling financial crisis and found that inflation has positive effect on growth when broad money exceeded the threshold level.

Overall, fiscal policy does not lead to significant economic growth. In contrast, monetary policy through real interest rate caused to lower economic growth while broad money led to the trade-off between inflation and growth. On the other hand, monetary policy is not effective to stimulate economic growth. When broad money is high or above the threshold value, it led to higher economic growth but was compensated with the trade-off cost of higher inflation. This study reported inefficient fiscal and monetary policy in the case of ASEAN countries.

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