Regime Changes in the Relationship between Stock Market Return and the Growth Rates of Output and Money Supply in Thailand

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Abstract

This paper examines the relationship between stock market return and two main macroeconomic variables (output growth and money growth) in Thailand during 1997Q3 and 2017Q4. The results from Markov switching vector autoregressive model reveal that there is regime switching between the bull market and the bear market. The positive impact of output growth on stock market return is significant in the bear market while the impact of money growth on stock market return is positive and significant in the bull market. This implies that monetary policy is effective only during the bull market period. For the bear market period, measures that stimulate economic growth should be necessary.

Keywords: stock return, regime changes, economic growth, monetary policy stance

JEL Classification: G10, E32, E52

1. Introduction

Since the emergence of empirical studies by Fama (1981) and Chen et al. (1986), numerous studies have investigated the relationship between stock market return and macroeconomic variables. Among others, Cheung and Ng (1998) find the existence of the long-run relationship between stock market return and macroeconomic factors in five major stock markets of the US, Canada, Germany, Italy and Japan. Most previous studies are based on the analysis of linear relationships. However, the finding by Canova and De Nicolo (2000) shows that the dynamic interrelationships between stock returns, real activity and inflation in the US, the UK, Japan and Germany are not statistically significant. It is possible that the relationship between stock market return and the macroeconomy is nonlinear. This nonlinear relationship might be accounted for via regime switching. Using a smooth transition regression, Bredin et al. (2007) find the presence of nonlinear influences in the relationship between stock retruns and the macroeconomy in Canada, France, Germany, the UK and the US. Chen (2007) finds that monetary policy has larger effects on the Standard & Poor 500 stock returns in the bear market period. Jansen and Tsai (2010) find that the impact of monetary policy in a bear market is large and significantly negative. The impact of a surprise monetary policy action in a bear market is greater than the impact of surprise monetary policy in a bull market for most industries. Laopodis (2013) examines the dynamic linkages between monetary policy and the US stock markets during the three monetary regimes. Evidence on significant and asymmetric effects of monetary policy on stock market

returns is observed for all regimes. These effects are more pronounced during the bear markets than the bull markets.

Empirical studies on Asian stock markets are relatively scarce. Among macroeconomic variables, money supply, short-term interest rate and exchange rate are used. Guo et al. (2013) employ a Markov switching model to examine the asymmetric impacts of monetary policy on stock market return in China and find that the impacts of interest rate and reserve rate vary across market cycles, but the impacts of money supply and exchange rate do not. However, Sun and Wang (2018) find that the impacts of money supply and interest rate vary across cycle in the Chinese stock market.

The movements of the Thai stock market index are shown in Fig. 1. The index is sharply dropped near the year 2008. This might stem from the impact of the 2008 global financial crisis.

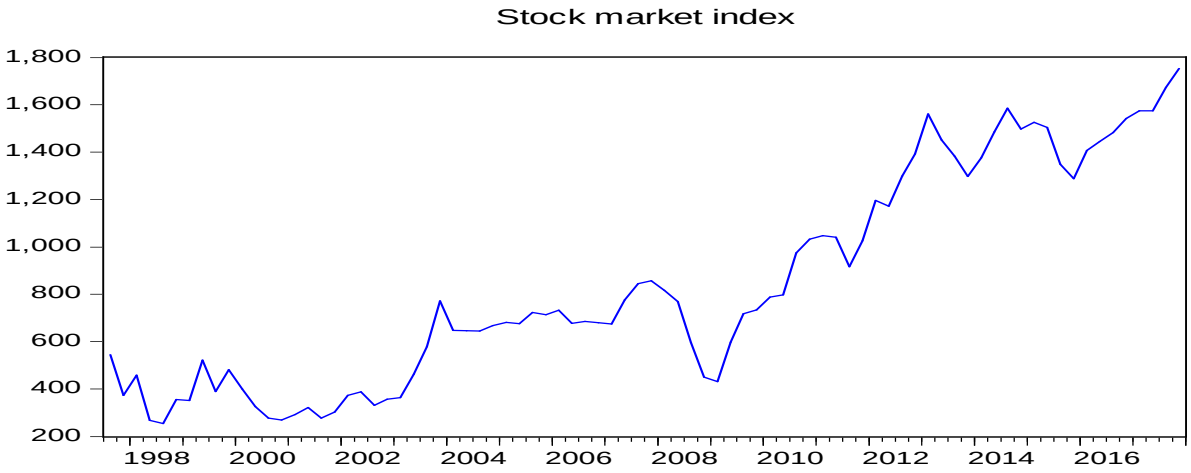

Fig. 1 Level of stock market index.

The main purpose of this paper is to investigate whether there exist regime changes in the impacts of output growth and money growth on the Thai stock market return. Time series data during 1997Q3 and 2017Q4 are used.[1] Markov switching model proposed by Hamilton (1989) is employed. This paper contributes to the existing literature by providing evidence showing that the impacts of output growth and money supply growth are different in the bull and bear market periods. The paper is organized as follows. Section 2 describes the data and estimation methods. Section 3 reports empirical results and concluding remarks are given in the last section.

2. Materials and Methods

2.1 Data

[1] This period is chosen so as to examine only the impact of the 2008 global financial crisis on emerging market stock return.

Quarterly data for stock prices, real GDP (chain volume measured), consumer price index, and broad money supply from the second quarter of 1997 to the fourth quarter of 2017 are used in this study. Stock market index (stock prices) is retrieved from the website of the Stock Exchange of Thailand, real GDP is retrieved from the website of National Economic and Social Development board, and broad money supply is retrieved from the website of the Bank of Thailand. All series are seasonally adjusted. To examine impacts of money growth and output growth on stock market return, output growth is a change in real GDP while the stock market return is computed as a change in stock market index, and real money supply is obtained by deflating nominal money supply by consumer price index. Therefore, money growth is a change in real money supply. The unit root tests for stationarity property of levels of series (stock market index, real GDP and money supply) and of first differences of series (stock market return, real GDP and money growth) are presented in Table 1.

Table 1
Results of Zivot-Andrew unit root tests.

Variable	PP test	ZA test	Break date
Level of series			
SP (Stock market index)	-0.728	-2.907	2009Q1
Y (Real GDP)	-0.222	-2.011	2009Q1
M (Money Supply)	-0.264	-1.630	2005Q2
First difference			
SR (Stock market return)	-10.364***	-9.854***	2009Q2
y (GDP growth rate)	-9.447***	-10.017***	2011Q4
m (Money growth)	-5.864***	-4.739**	2012Q3

Note: ***, ** and * indicate significance at the 1%, 5% and 10% respectively. The lag length for ZA tests is determined by Akaike information criterion (AIC).

The Philiips-Perron (PP) and Zivot and Andrew (ZA) unit root tests with constant show that the three series contain a unit root because the null hypothesis of unit root for the levels of the series cannot be rejected, but the tests of their first difference can be rejected at least at the 5% level of significance. Therefore, it is clear that all series are integrated of order one, i.e. they are I(1) series.

2.2 Methods

To test for the impacts of the rates of growth of output and money supply on a stock market return, the traditional vector autoregressive (VAR) model with the lag order p is expressed as:

$$Y_t = \mu + \sum_{i=1}^{p} A_i Y_{t-i} + \varepsilon_t \qquad (1)$$

where Yt = [SR_t, y_t, m_t]': SR_t is stock market return, y_t is the growth rate of real GDP, and m_t is the growth rate of money stock, and εt is a random error. However, it is possible that the estimate of the unrestricted VAR model may not be able to detect the impacts of output growth and real money growth on stock market return if these impacts are not symmetric. Therefore, a nonlinear model might be suitable.

The Markov switching vector autoregressive (MS-VAR) model proposed by Hamilton (1989) is expressed as:

$$Y_t = \mu S_t + \sum_{i=1}^{p} A S_t Y_{t-i} + \varepsilon_t \qquad (2)$$

The unknown state variable S_t follows a M-state Markov process with the transition probability in different regimes are $Pr[S_t = j|S_t - 1 = i] = P_{ij}$. The MS-VAR model can be expressed as:

$$Y_t - \mu S_t = A_1 S_t (Y_{t-1} - \mu S_t) + A_2 S_t (Y_{t-2} - \mu S_t) + ... + A_p S_t (Y_{t-p} - \mu S_t) + \varepsilon_t \qquad (3)$$

where $\mu S_t \sim NID(0, \Sigma S_t)$, and the parameters, μ, A_1, A_2, ….A_p, depends on the state of S_t.

The MS-VAR model can be used to examine the impacts of monetary policy on stock market return in two regimes: the bull and bear markets. The broad monetary aggregate defined by the Bank of Thailand is used a monetary policy measure. Therefore, economic growth and changes in the quantity-based direct monetary instrument are used to examine regime switching in the impacts of two macroeconomic variables on stock market return.

3. Empirical Results

Based on the results of unit root tests are shown in Table 1, the first attempt is to estimate an unrestricted VAR model. The optimal lag of 2 is determined by AIC.[2]

Table 2
Results of VAR(2) model.
Dependent variable: Stock market return (SR_t)

Variable	Coefficient	Standard error	t-statistic
SR_{t-1}	-0.135	0.120	-1.126
SR_{t-2}	-0.028	0.124	-0.228
y_{t-1}	0.830	1.005	0.825
y_{t-2}	1.310	0.920	1.423
m_{t-1}	0.142	1.759	0.081
m_{t-2}	1.651	1.732	0.953
D_t	-0.230**	0.009	2.558
Intercept	-0.019	0.039	-0.480

Note: ** indicates significance at the 5% level.

The results in Table 2 show that all coefficients are statistically insignificant, except for the coefficient of the dummy variable that captures the impact of the global financial crisis. Therefore, output growth and monetary instrument do not exert any impact on stock market

[2] Gregory and Hansen (1996) is performed using level of the series of the log of stock market index, the log of real GDP and the log of real money supply. The t-statistic is -4.904, which is smaller than the 5% critical value of -4.92 in absolute value. Therefore, cointegration or long-run relationship is not found.

return.[3] The results lead to casting doubt on the reliability of a linear VAR model. In other words, the relationship might be nonlinear. To analyze the different impacts of the growth rates of GDP and monetary aggregate on stock market return, the Markov switching model comprises two regimes. The first regime is the regime of positive returns or the bull market while the second regime is the one of negative returns or the bear market. The order of autoregressive process is 2 chosen by AIC. Table 3 reports the results when nominal stock market return is the dependent variable.

Table 3
Results of MS(2)-VAR(2) model.
Dependent variable: Stock market return (SR_t)

Variable	Regime 1	Regime 2
SR_{t-1}	0.073	-0.044
	(0.126)	(0.133)
	[0.565]	[0.738]
SR_{t-2}	-0.436***	0.868***
	(0.125)	(0.164)
	[0.001]	[0.000]
y_{t-1}	-0.573	1.385
	(0.839)	(1.379)
	[0.656]	[315]
y_{t-2}	0.225	3.191**
	(0.748)	(1.258)
	[0.763]	[0.011]
m_{t-1}	0.002	0.468
	(0.998)	(2.705)
	[0.001]	[0.863]
m_{t-2}	2.725**	-2.044
	(1.371)	(2.420)
	[0.047]	[0.313]
D_t = -0.257***[0.000]		

Note: Standard error is in parenthesis and p-value of t-statistic is in bracket. ***, ** and * indicate significance at the 1%, 5% and 10% respectively.

Similar to the results of the VAR(2) model, the impact of the 2008 global financial crisis is significantly negative and weakens the relationship. It is apparent that the impacts of output and money growth rates on stock market return are different across regimes. The coefficient of two-period lagged output growth is positive and significant at the 5% level in the bear market (regime 2), while none of the coefficients of lagged output growth variables are significant. This implies that output growth causes stock market return to increase only in the bear market. On the contrary, the coefficient of two-period lagged money growth is positive and significant at the 5% level of significant while none of lagged output growth variables are significant in the bull market. The results indicate that money growth causes stock market return to increase only in the bull market, but not in the bear market.

[3] In the sense of causality test (Granger, 1988), there is no causality running from output growth and money growth to stock market return since the coefficients of lagged independent variables are not statistically significant.

It should be noted that the growth rate of money supply is positively related to the rate of return of the stock market when the market is in the bullish regime. Therefore, it is obvious that monetary policy influences the bull market liquidity directly and seems to be dependent on the regime switching. The finding is not in line with the findings by Chen (2007), Jensen and Tsai (2010), Laopodis (2013), and Guo et al. (2013).

Table 4 reports the transition probabilities matrix and expected duration of each regime.

Table 4
Transition probabilities and expected duration.

	Regime 1	Regime 2	Duration
Regime 1	0.764	0.236	4.241
Regime 2	0.440	0.560	2.275

Note: The number is $p_{ij} = Pr[S_t = j|S_{t-1} = i]$, where i = 1,2 and j =1,2.

Table 4 presents the matrix of transition probabilities and expected duration. The transition probability for regime 1 is 0.764, and the transition probability for regime 2 is 0.560. The transition probabilities across regimes are close to each other, which indicate that fluctuations during the sample period are frequent. The expected duration of the bull market is longer than that of the bear market. The regime frequency is 65% and 35% respectively, implying that the length of the bull market is quite longer than that of the bear market.

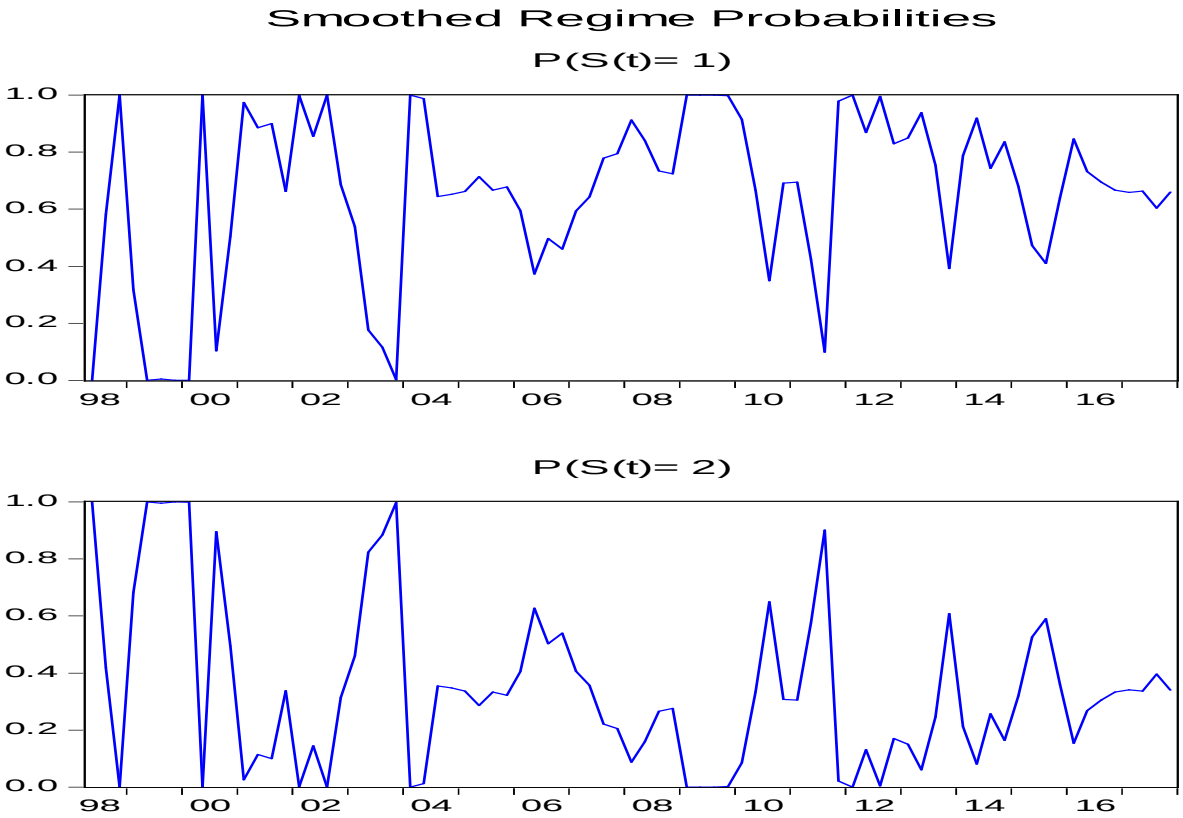

Fig. 2 Smoothed probabilities in regime 1 and regime 2.

The smooth transition probabilities for the bull and the bear market periods are shown in Fig. 2. The smoothed transition probabilities are used to divide the whole sample period into

the bull and the bear market periods. A simple method of identifying the bullish and bearish periods proposed by Pagan and Sossounov (2003) are based on the peaks and troughs of the stock market index as shown in Fig. 1. A non-linear model that can determine the regimes is the smoothed probabilities shown in Fig. 2. Based on these criteria, regime 1 is the bullish period and regime 2 is the bearish period. The bullish periods are from 1997Q3 to 2002Q4 and from 2007Q5 to 2008Q4 when the regime probabilities are high. On the contrary, the bearish periods are from 2003Q1 to 2007Q4 and from 2009Q1 to 2017Q4 when the regime probabilities are low. These results confirm the validity of the estimated MS(2)-VAR(2) model as reported in Tables 3 and 4.

4. Concluding Remarks

In this paper, Thailand's stock market is the research object to be used to test for regime changes that affect the impacts of output and money growths on stock market return. By applying a MS(2)-VAR(2) model to the dataset during 1997Q3 and 2017Q4, the conclusions that can be made from the estimation from the analysis are as follows. First, monetary policy takes effect only in the bullish market period. Second, economic growth affects stock market return only in the bearish market period. In other words, there are regime changes in the relationship between stock market return and the growth rates of output and money supply. The impact of the 2008 global financial crisis on this relationship is negative and minimal. The main findings in this paper give implications for stock market participants and policymakers in that they should pay attention to regime changes that affect the impacts of key economic factors on stock market return.

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