PROSIDING PERKEM VIII, JILID 1 (2013) 480 - 492
ISSN: 2231-962X

Monetary Policy Effectiveness and Stock Market Cycles in ASEAN-5

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ABSTRACT

This paper examines the asymmetric effects of monetary policy on real output in Bull and Bear phases of stock market in five ASEAN economies (Malaysia, Singapore, Indonesia, the Philippines and Thailand) using the recently developed pooled mean group (PMG) technique. Stock market cycles are identified by employing Markov-switching models and the rule-based non-parametric approach. Estimating the models using monthly data from 1991:1 to 2011:12, the results show that monetary policy (measured by short-term interest rate) has a negative and statistically significant long-run effect on real output in bull and bear market periods while the effects are stronger in bear periods than bulls. In the short-run, there is not statistically significant relationship between monetary policy and real output. These results are consistent with finance constraints (capital market imperfection) models which predict that monetary policy is more effective during bear periods than bulls.

Keywords**:** Monetary policy, stock market cycles, asymmetry, Pooled Mean Group, Markov switching
JEL Classification codes: E52, E32, C33, G10.

INTRODUCTION

The asymmetric real effects of monetary policy on the economy are widely accepted by the macroeconomists. Asymmetric effects, in the context of monetary policy, refer to a situation in which the effects of a given policy are not constant but vary depending on circumstances. In recent years, a large and growing body of empirical studies have focused on different kinds of asymmetric effects of monetary policy on real output.[2] A new strand of literature has focused on the asymmetric response of stock return to monetary policy shocks.[3] In this research we combine these two types of asymmetry and contribute to the existing literature by studying the asymmetric effects of monetary policy on real output concerning stock market conditions in the five original members of ASEAN countries, namely ASEAN-5 including: Malaysia, Singapore, Indonesia, the Philippines and Thailand.

More specifically, our main objective is to investigate the asymmetric impact of monetary policy on real output[4] with respect to stock market conditions, as indicated by the market being characterized as a bull or bear market. The finance constraints models predict that monetary policy is more effective in bear market periods than bulls. When there is asymmetric information in the financial markets borrowers may behave as if they are constrained financially. The fact that financial constraints are more likely to bind in bear markets affirms that monetary policy has greater effects in bear markets (Chen, 2007).

The examination of the asymmetric effects of monetary policy in different stock market conditions is crucially important because monetary policy actions affect the ultimate objectives of monetary policy i.e. output, employment and inflation indirectly through financial markets (Bernanke

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[2]Such as: (1) asymmetry associated with the direction of the monetary policy action, (2) asymmetry related to the size of the monetary policy, (3) asymmetry over the business cycle and (4) asymmetry during different inflation regimes.
[3]Several such asymmetries have been suggested in the literature, including the possibility that the response of stock returns depends on the direction of monetary policy shocks, or on the phase of the business cycle, or on the stock market being in a bullish or bearish period.
[4]In the analysis, manufacturing production is used to proxy real output since monthly GDP was not available during the time dimension considered in the study.

& Kuttner, 2005). The importance of the stock market in transmitting the effects of monetary policy is well documented in the context of developed economies. The significant role of financial markets in monetary transmission mechanism is also verified in the ASEAN-5 countries.[5] On the other hand, as a result of financial reform undertaken since the early 1980s the ASEAN-5 stock markets have developed significantly. The average market capitalization (defined as the total market value of all listed shares divided by GDP) for Singapore and Malaysia over the sample period (1991-2011) is 168.37% and 167.26% respectively which means that market capitalization value is higher than GDP indicating a large stock market in these countries. The average market capitalization for Thailand, the Philippines and Indonesia is 59.06%, 53.32% and 27.60% respectively. However, in recent years (2010-2011) the market capitalization ratio is over 70% for Thailand and the Philippines and around 50% for Indonesia demonstrating the growing role of the stock market in these economies.

Due to the extensive development of stock market and the significant role of financial markets in monetary transmission mechanism in these economies policymakers should take stock market into consideration while setting their monetary policies. On the other hand, as depicted in FIGURE 1 the movement of real output in bull and bear market periods of the ASEAN-5 countries is dissimilar. Output is declined in most of the bear market periods, especially in bearish periods after 1997 Asian financial crisis and then again in the aftermath of global financial crisis in 2007, and increased in bull phases which may signal the asymmetric response of output to monetary policy in bull and bear market periods. If monetary policy asymmetrically affects real output in bull and bear market periods, policymakers should consider not only the overall status of the stock market in their policymaking decisions but also the specific status of the market characterized as bull and bear market periods. Evidences of cyclical variation in the response of real output to monetary policy help policymakers to predict correctly the effect of a target rate change on the real economy. In the presence of such asymmetries, monetary authorities must condition any shifts in policy on the specific status of the stock market. Do failure to consider asymmetry result in wrong conclusions concerning the impact of monetary policy?

Although the asymmetric effects of monetary policy in the context of developed countries have been reported extensively in the literature, less empirical evidences have been reported for the developing economies and even less for ASEAN-5 countries.[6] Since the environment in which ASEAN-5 economies operate (for instance degree of financial development) is significantly different with that of developed economies, the findings of asymmetry in developed economies cannot be generalized to ASEAN-5 economies. Owing to the insufficiency of empirical literature related to the issue of asymmetry in ASEAN-5 economies, studying the asymmetric behaviour in these economies can clarify does asymmetric monetary policy effects exist across a wider range of economies including developing ones?

All the studies reviewed so far investigate the asymmetric effects of monetary policy using time series econometric approaches. We contribute to the existing literature by studying the asymmetric effects of monetary policy on real output in ASEAN-5 countries in a panel setting by employing the recently developed pooled mean group (PMG) estimator proposed by Pesaran *et al.* (1999). Since we look into the asymmetries over bull and bear markets, it requires us to identify these terms. Bull and bear periods will be identified by employing Markov-switching models and rule-based nonparametric approach proposed by Pagan and Sossounov (2003). The empirical results of this paper indicate that monetary policy significantly affects real output in the long-run while the estimates are not statistically significant in the short-run. Moreover, monetary policy is more effective in bear market periods than bulls as predicted by finance constraints models. The rest of the paper is organized as follow. Sections 2 gives the results of earlier empirical studies while, Section 3 describes methodology and data description and sources. Empirical results are presented in section 4 and section 5 concludes.

LITERATURE REVIEW

In recent years, a large and growing body of empirical studies has focused on asymmetric effects of monetary policy on the economy. Several such asymmetries have been suggested in the literature. For instance Cover (1992), Karras (1996), Florio (2005) studied asymmetry associated with the direction of

[5]See for instance Raghavan *et al.* (2012) who confirmed the role of asset prices in intensifying the effects of both interest rate and money shocks on output in Malaysia. Sriphayak and Vongsinsirikul (2007) found that asset prices play a central role in transmitting the effects of monetary policy to real output in Thailand.

[6]See for instance Tan and Habibullah (2007) who studied the asymmetric effects of monetary policy over business cycle in four ASEAN countries namely Malaysia, Indonesia, the Philippines and Thailand.

monetary policy and found that a tight monetary policy is more effective than an easy one. Weise (1999) and Lo and Piger (2005) among others, analyzed the asymmetry related to the size of monetary policy and showed that small monetary shocks have greater impact on output than big shocks. Several studies have revealed that monetary policy is more effective in recessions than booms (Garcia & Schaller, 2002; Kakes, 1998; Tan & Habibullah, 2007).

Other strands of empirical literature have investigated the asymmetric response of stock returns to monetary policy shocks. Some emphasized on the asymmetric response of stock returns to positive and negative monetary policy shocks (e.g. Bernanke and Kuttner, 2005, Chulia *et al.* 2010). A number of them have looked into the asymmetry over business cycle (see for instance Basistha and Kurov, 2008) and some of them have explored the asymmetries in bull and bear market periods. Chen (2007), Kurov (2010) and Jansen and Tsai (2010) provided evidences that stock returns respond much stronger to monetary shocks in bear markets than bulls. However, the asymmetric real output effects of monetary policy concerning stock market conditions have not been sufficiently explored in the previous literature. This gap, mixed results and insufficiency of empirical studies in the ASEAN-5 countries deserve further research.

METHODOLOGY

Identification of The Stock Market Cycles

The purpose of this study is to investigate the possibly asymmetric impact of monetary policy on real output in bull and bear markets. To this end, we first require accurate identification of bull and bear market periods. However, there is not a single preferred method for this purpose in the academic literature. The literature suggests two main approaches for identification of bullish and bearish periods. The first approach is a model-based method and makes use of Markov regime-switching models developed by Hamilton. They belong to the category of methods that are based on a parametric specification of data generating process (DGP) underlying asset prices.[7] The second approach is based on a non-parametric methodology and uses a set of rules to detect bull and bear periods. Pagan and Sossounov (2003) employed this procedure to identify stock market cycles.[8] In this research, we use both parametric and nonparametric approaches (denoted by Model 1 and Model 2) to identify the bear and bull stock markets.

Model 1: A two-state Markov-switching model

Consider the following process of a simple two-state mean/variance Markov-switching model:

$$R_t = \mu_{S_t} + \epsilon_t, \qquad \epsilon_t = i.i.d\ N\left(0, \sigma^2_{S_t}\right) \tag{1}$$

Where $S_t = 1,2,\ldots,k$ is the number of states and ϵ_t follows a Normal distribution with zero mean and variance given by $\sigma^2_{S_t}$. Let $R_t = 100.\Delta P_t$, where P_t is the logarithm of the nominal stock price. Therefore, R_t can be interpreted as stock returns. The value of μ_1 is the expected return on a bull market state, which implies a positive log return for R_t. The lower value μ_2 measures the expected return for the bear market state, which then implies a negative trend in prices. The different volatilities $\sigma_1^2(\sigma_2^2)$ in each state represent the different uncertainty regarding the predictive power of the model in each state of the world. If the dependent variable is the stock returns, we expect that the bear market state is more volatile than the bull market. This implies that prices go down faster than they go up[9]. This means that we can expect σ^2_{bear} to be higher than σ^2_{bull}.

For a Markov regime switching model, the transition of states is stochastic (and not deterministic). This means that one is never sure whether there will be a switch of state or not. But, the dynamics behind the switching process is known and driven by a transition matrix. This matrix will control the probabilities of making a switch from one state to the other. If we consider $S_t = 1$ indicate the bull market state and $S_t = 2$ the bear market state, the transition probability matrix for a two-state Markov process can be represented as:

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[7]See Chen (2007) and Kurov (2010) for application.
[8]See also Jansen and Tsai (2010) for application.
[9]One possible explanation for this effect is that traders react faster to bad news when comparing to good news.

$$p = \begin{bmatrix} p^{11} & p^{12} \\ p^{21} & p^{22} \end{bmatrix} \tag{2}$$

Where, p^{ij} controls the probability of a switch from state j to state i .

$$p^{\uparrow}ij = p(S_{\downarrow}t = j|S_{\downarrow}(t-1) = i)\dashv \tag{3}$$

With $\sum_{j=1}^{2} p^{ij} = 1 \quad for\ all\ i$

Usually the functions of the transition probabilities are assumed constant over time but, it is possible to allow it to vary over time[10]. The constant transition probability function takes the following logit form:

$$p^{\uparrow}11 = p(S_{\downarrow}t = 1|S_{\downarrow}(t-1) = 1)\dashv = exp\{\theta_{\downarrow}1\}/(1 + exp\{\theta_{\downarrow}1\}) \tag{4}$$

$$p^{\uparrow}22 = p(S_{\downarrow}t = 2|S_{\downarrow}(t-1) = 2)\dashv = exp\{\gamma_{\downarrow}1\}/(1 + exp\{\gamma_{\downarrow}1\}) \tag{5}$$

The parameters θ_1 and γ_1 determine the transition probabilities through the logistic distribution functions in (4) and (5).[11] When the two regimes (the bear and bull markets) have been statistically identified, we can compute the so-called filtered probabilities of each state which are the probabilities of being in each state given the information set available at time t (y^t):

$$Q_{j,t} = p(S_t = j|y^t), \qquad j = 1,2 \tag{6}$$

The filtered probabilities provide information about the regime in which the series is most likely to have been at every point in the sample. These probabilities are very useful for dating switches in the series.

Model 2: the nonparametric dating algorithm approach

In the business cycle literature Bry and Boschan (1971) devised an algorithm for monthly observations which is based on formal, consistent and quantifiable rules for describing turning points. Bry-Boschan program is basically a pattern-recognition program and detects local peaks and troughs in the business cycle using certain rules. Pagan and Sossounov (2003) adapted the Bry-Boschan algorithm for use in stock markets by making a number of modifications due to the more volatile nature of financial markets. First, the data are not smoothed at all because of the large movements that are possible in equity markets. Smoothing the data and the process of eliminating the outliers may suppress some of the most important movements in the series. Their second deviation from Bry-Boschan program relates to the size of window used in locating the initial turning points. In the Bry-Boschan program this is six months. Due to the lack of smoothing Pagan and Sossounov (2003) made this slightly longer and eventually settled on eight months as the proper length for stock prices. Therefore, there is a peak at time t if:

$$[p_{t-8}, \dots, p_{t-1} < p_t > p_{t+1}, \dots, p_{t+8}] \tag{7}$$

and there is a trough at time t if:

$$[p_{t-8}, \dots, p_{t-1} > p_t < p_{t+1}, \dots, p_{t+8}] \tag{8}$$

Where p_t denotes the natural log of the stock price. Pagan and Sossounov (2003) set the minimal length for stock market phase at four months, whereas a complete cycle is required to last at least 16 months (rather than 15 months in business cycle dating). Finally, due to the sharp movements in stock prices some quantitative constraints (censoring rules) are appended to the rules above in order to avoid identification of spurious cycles. After detection of the final turning points by applying the censoring operations, the peak-to-trough and the trough-to-peak periods are identified as the bear and the bull market periods, respectively.

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[10]This is called the time varying transition probabilities (TVTP) model.

[11]The maximization algorithm for the specifications (1) to (5) is described in detail in Hamilton (1989).

Measuring Monetary Policy

There is no consensus on how to measure the stance of monetary policy. The traditional approach identifies monetary policy with monetary aggregates.[12] Using a monetary aggregate gives rise to an identification problem. The growth rates of monetary aggregates are not purely exogenous and may reflect endogenous responses of policymakers to events such as oil price shocks and economic development which can be anticipated and should therefore be ineffective. Moreover, change in monetary growth might reflect a change in the demand for money as well as change in money supply (Kakes, 1998). The deficiencies of monetary aggregate as a measure of the stance of monetary policy induced many researchers to find alternative indicators.

Bernanke and Blinder (1992) emphasized the role of the Federal funds rate as an indicator of the stance of monetary policy. They showed that the funds rate is less likely to reflect endogenous response of policymakers to economic conditions than money aggregates. Since Bernanke and Blinder (1992) many researchers in developed and developing countries have used short-term interest rate to measure the stance of monetary policy. Since 1990s monetary authorities in ASEAN-5 economies have shifted their policy emphasis from money aggregate towards short-term interest rate. Accordingly, as being in line with many empirical studies in ASEAN-5 economies (Agung, 1998; Ibrahim, 2005; Raghavan et al., 2012; Siregar & Goo, 2010) we use the short-term interest rate as our monetary policy indicator[13].

The Pooled Mean Group Estimator (PMG)

To investigate the possible asymmetries in the effect of unexpected monetary policy shocks in bull and bear market periods we employ the Pooled Mean Group (PMG) estimator of Pesaran *et al.* (1999). The advantage of this approach is that it does not require us to pre-test the existence of (panel) unit roots and (panel) cointegration and can be applied to stationary as well as nonstationary variables (Kim, Lin, & Suen, 2010). This circumvents some problems in cointegration analysis that focuses only on the estimation of long-run relationships among nonstationary variables, as well as the low power of unit-root tests against plausible alternatives. Additional advantage of the PMG approach is that it offers estimates on the long-run relationship as well as the short-term coefficients among variables of interest.

In the time series framework, Pesaran *et al.* (1999) proposed the autoregressive distributed lag models (ARDL) to estimate the long-run cointegrating relationship among variables of interest. In a panel data framework, suppose that the long-run relationship between y_t and x_t is given by:

$$y_{it} = \mu_i + \theta x_{it} + \epsilon_{it} \tag{9}$$

Where μ_i is the fixed effects, $i = 1, 2, \ldots, N$, and $t = 1, 2, \ldots, T$. Pesaran *et al.* (1999) suggest nesting Equation (9) in a general ARDL specification to allow for rich dynamics. For instance, the ARDL$(p, q, q, \ldots, q)$ model can be written as:

$$y_{it} = \mu_i + \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} X_{i,t-j} + \varepsilon_{it} \tag{10}$$

Where $X_{it}(k \times 1)$ is the vector of explanatory variables (regressors) for group i including the variable of interest and other control variables; λ_{ij} represent the coefficients of the lagged dependent variables and are scalars; and δ_{ij} are $(k \times 1)$ coefficient vectors. By reparameterization, Equation 10 can be written as an error correction form:

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[12]Cover (1992), Karras (1996), Tan and Habibullah (2007) among others, used monetary aggregates as measure of money supply shock. In these studies residuals of money supply equations used to identify the stance of monetary policy.

[13]The identification problem with monetary aggregates, mentioned above, may remain present with the federal funds rate. The funds rates are not purely exogenous (Kakes, 1998; Chen, 2007). To solve this identification problem many researchers have used orthogonalized innovations from the VAR models. See for instance: Bernanke and Blinder (1992), Kakes (1998), Garcia and Schaller (2002), Lo and Piger (2005), Chen (2007) and among others. In this research we also used Choleski orthogonalized innovations to interest rate from VAR models to measure monetary policy shocks but, we couldn't find any significant relationship between this measure of monetary policy and real output. The results are available upon request.

$$\Delta y_{it} = \mu_i + \phi_i y_{i,t-1} + \beta_i' X_{it} + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*\prime} \Delta X_{i,t-j} + \varepsilon_{it} \tag{11}$$

Where

$$\phi_i = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right), \qquad \beta_i = \sum_{j=0}^{q} \delta_{ij}$$

$$\lambda_{ij}^* = -\sum_{m=j+1}^{p} \lambda_{im}, \qquad j = 1,2,\ldots,p-1$$

and

$$\delta_{ij}^* = -\sum_{m=j+1}^{q} \delta_{im}, \qquad j = 1,2,\ldots,q-1$$

By further grouping the variables in levels, Equation (11) can be rewritten as:

$$\Delta y_{it} = \mu_i + \phi_i(y_{i,t-1} - \theta_i' X_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*\prime} \Delta X_{i,t-j} + \varepsilon_{it} \tag{12}$$

Where $\theta_i = -\left(\beta_i / \phi_i\right)$ measures the long-run or equilibrium relationship among y_{it} and X_{it}. The short-run coefficient relating y_{it} and X_{it} is defined by λ_{ij}^* and δ_{ij}^*. Moreover, ϕ_i measures the speed of adjustment of y_{it} toward its long-run equilibrium following a change in X_{it}. $\phi_i < 0$ ensures that such a long-run relationship exists. Accordingly, discovery of a significantly negative ϕ_i can be treated as evidence supporting cointegration between y_{it} and X_{it}.

In the literature, there are alternative procedures for estimating the above model. Among which, the mean group (MG) estimator proposed by Pesaran and Smith (1995) imposes no cross-country coefficients constraints. The dynamic fixed-effect (DFE) method allows the intercepts to differ across groups but imposes homogeneity of all slope coefficients and error variances. Alternatively, Pesaran *et al.* (1999) propose the PMG estimator, which restricts the long-run parameters to be identical across groups but, allows the intercepts, short-run coefficients (including the speed of adjustment), and error variances to differ across groups. If the long-run homogeneity restrictions are valid, the MG estimates are inefficient and the maximum likelihood–based PMG approach yields a more efficient estimator. Particularly, Pesaran *et al.* (1999) proposed a standard Hausman type statistic to test for the validity of long-run homogeneity restriction and hence the suitability of the PMG estimator. If the Hausman test cannot reject the null hypotheses of the homogeneity of long-run coefficients, the PMG estimator is preferable to the MG estimator.

Data Description and Sources

In this study we utilize monthly data of ASEAN-5 countries including Malaysia, Indonesia, Thailand, the Philippines and Singapore. The estimation sample is a balanced panel spanning from 1991:1 to 2011:12. Our dataset is taken from DataStream. In the analysis, the monthly manufacturing production index for each country is adopted to proxy the domestic output. For the key monetary policy variable, we employ the 3-month Treasury bill rate for the Philippines, Malaysia and Singapore and the money market rates (federal funds) for Indonesia and Thailand due to the availability of the data during the sample period.

To construct bullish and bearish periods we utilize the stock market indices of ASEAN-5 economies including: the Jakarta Stock Exchange composite index (JSE) for Indonesia, the Kuala Lumpur Composite Index (KLCI) for Malaysia, the Stock Exchange Composite Index (PSE) for the Philippines, the Straits Times Stock Price Index (STI) for Singapore and the Bangkok Stock Exchange Price Index (SET) for Thailand. To strengthen our empirical results, we add some relevant control

variables in the models including the ratio of government consumption to GDP (lgc) to account for the role of government in economic development, the ratio of exports over imports $(ltrade)$ as a proxy to gain from trade and inflation rate (inf) as an indicator of macroeconomic stability. Inflation is calculated as the percentage change in the Consumer Price Index.

EMPIRICAL RESULTS

Identification of The Stock Market Cycles using Markov-Switching Model

TABLE 1 presents the estimation results for a simple mean/variance Markov-switching model. The Markov-switching model identifies the high-return stable and low-return volatile states in stock returns[14] which are conventionally labeled as bull and bear markets, respectively. Obviously, the Markov-switching model has well identified the bull and bear markets in stock returns. Moreover, the transition probabilities show that both bull and bear market states are highly persistent and a bear is supposed to continue for a shorter period than a bull.

FIGURE 2 plots the smoothed probabilities of state 1 (bull markets). When the probabilities are greater (less) than 0.5, the market is more likely to be in a bull (bear) market. As observed in FIGURE 2, the regime switching model is able to delineate the bear market periods associated with the 1997-98 Asian financial crises and 2007 global financial crisis.

The Results of Estimating Baseline Model

We begin by looking at the effects of monetary policy on real output without considering stock market conditions. We estimate the following regression in a panel setting where y_{it} is the natural logarithm of manufacturing production index and m_{it} is the monetary policy indicator measured by short-term interest rate.

$$y_{it} = \alpha_i + \beta_i m_{it} + \varepsilon_{it} \tag{13}$$

Column (1) of TABLE 3 presents the PMG estimates of the long-run coefficients, error correction term, short-run coefficients and joint Hausman test statistics of baseline model.[15] The Hausman test statistics fails to reject the homogeneity of long-run coefficients. Hence, the PMG estimator is more efficient than the MG estimator. The coefficient on the error correction term is significantly negative and within the unit circle, implying that there is a long-run relationship between variables. The long-run coefficient of the interest rate is negative and statistically significant at 1% significance level using PMG estimates. The PMG estimate indicates that in the long-run a 100 basis point increase in the policy rate (contractionary monetary policy) will lead to 6.9% decrease in real output. The short-run coefficient of interest rate is statistically insignificant using PMG estimates.

Asymmetric Effects of Monetary Policy

To investigate the asymmetric impact of monetary policy over bull and bear markets, we estimate the following regression:

$$y_{it} = \alpha_i + \beta_{1i} m_{it} * (bull_{it}) + \beta_{2i} m_{it} * (1 - bull_{it}) + \varepsilon_{it} \tag{14}$$

Here, m_{it} is the policy variable as described before and $bull_t$ is a dummy variable for bull market periods constructed using Markov-switching models and non-parametric approach. The term $bull_{it}$ takes the value of one when stock market is in bullish periods and zero otherwise. The terms $m_{it} * (bull_{it})$ and $m_{it} * (1 - bull_{it})$ are indicator variables for examining the effects of monetary policy in bull and bear periods, respectively. The indicator variables for monetary policy in bull and bear states are constructed following Basistha and Kurov (2008), Kurov (2010) and Jansen and Tsai (2010). The possible asymmetries in the real output effects of the monetary policy can be tested by simply comparing the estimated coefficients of constructed monetary policy indicators in bull and bear markets.

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[14]Except for the Philippines which the high return state corresponds to volatile state.
[15]The results of the MG and DFE estimators are available upon request.

Column (1) of TABLES 4 and 5 displays the PMG estimates of the real output effects of monetary policy in bull and bear market periods. TABLE 4 reports the results for the case that stock market cycles are identified using non-parametric approach. TABLE 5 is based on the identification of stock market cycles via Markov-switching models. In both cases that stock market cycles are identified using non-parametric approach or Markov-switching models the Hausman test fails to rejects the long-run homogeneity restriction at conventional significance level, indicating that the PMG estimate is preferable to the MG estimate. The coefficient on the error correction term is significantly negative and smaller than unity, implying that there is a long-run relationship between variables.

The long-run coefficients of monetary policy in bull and bear market periods displayed in column (1) of TABLES 4 and 5 are negative and statistically significant using PMG estimates. Moreover, the PMG estimates indicate that the impact of monetary policy in a bull market is smaller in magnitude than the impact in a bear market. The short-run coefficients of monetary policy in bull and bear market periods are statistically insignificant. It is worth stressing that the empirical results from Markov-switching identification of cycles are very similar to what obtained from non-parametric models, thus making the estimates robust.[16] These results are in line with findings of Chen (2007), Kurov (2010) and Jansen and Tsai (2010) who provided evidences that monetary policy is more effective in bear market periods than bulls.

Robustness Test

To check the sensitivity of our empirical results to model specification, we add some relevant control variables into the equations (13) and (14) including the ratio of government consumption to GDP (lgc_{it}), the ratio of exports to imports as a proxy for gains from trade $(ltrade_{it})$ and inflation rate $[(inf]_{it})$[17]. These variables are included following Barro (1997) growth models[18]. The inclusion of these explanatory variables may lessen the potential problem of omitted variable bias.

TABLES 3 to 5 report the PMG estimation results of all possible combinations of control variables added to the equations (13) and (14). These models are named as augmented models. The estimation outcomes depicted in Columns (2)-(8) are qualitatively similar to that in column (1). The error-correction terms are significantly negative and within the unit circle, indicating that there is a long-run equilibrium relationship among the variables. The signs and statistical significance of both long and short-run coefficients of monetary policy remain unchanged except in TABLE 5 column (2) where government consumption is augmented to model (14). The long-run coefficient of monetary policy in augmented models indicate that a contractionary monetary policy (interest rate increases) leads to a decrease in real output, no matter if the stock market is in a bull or bear regime. Moreover, monetary policy is more effective in bear market periods than bulls. In the short-run monetary policy is no longer effective in bull and bear market periods. Consequently, our main findings do not seem to suffer severely from common omitted variable bias.

The estimated coefficients of control variables in long and short-run indicate that government consumption and inflation negatively affect real output only in the short-run. These variables seems to have a positive long-run effect on real output. Trade has a significant positive long-run impact on real output while in the short-run the effects are not statistically significant. For all control variables, their long-run impacts appear to be stronger than those in the short run.

CONCLUSION

This paper examines asymmetries in the impact of monetary policy on real output between bull and bear market periods in the ASEAN-5 economies including: Malaysia, Singapore, Indonesia, the Philippines and Thailand using monthly data spanned from 1991:1 to 2011:12. We utilized short-term interest rate as suitable monetary policy indicator because interest rate is the key policy variable in ASEAN-5 countries after the liberalization of interest rates since the 1980s. Bull and bear market periods are identified by employing the Markov-switching models and the rule-based non-parametric approach. To investigate the possible asymmetries we employed the Pooled Mean Group (PMG) estimator proposed by Pesaran *et al.* (1999).

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[16]The results for estimating the models using MG and DFE estimators are available upon request.

[17]All variables except inflation rate are in natural logarithms.

[18]In this growth model other control variables such as the level of initial development (as proxied by GDP per capita), physical capital, human capital and institutions are included. In this research we utilize monthly data of ASEAN-5 countries and these variables are not available in a monthly frequency.

The results of the baseline model indicate that there is a negative and statistically significant long-run relationship between monetary policy indicator (short-term interest rate) and real output. The PMG estimates of the long-run coefficients of monetary policy in bull and bear market periods indicate that monetary policy significantly affect real output in both bull and bear market periods while the effects are stronger in bear periods than bulls. In the short-run, we couldn't find significant relationship between monetary policy and real output. These results are consistent with finance constraints models which predict that monetary policy is more effective during bear periods than bulls.

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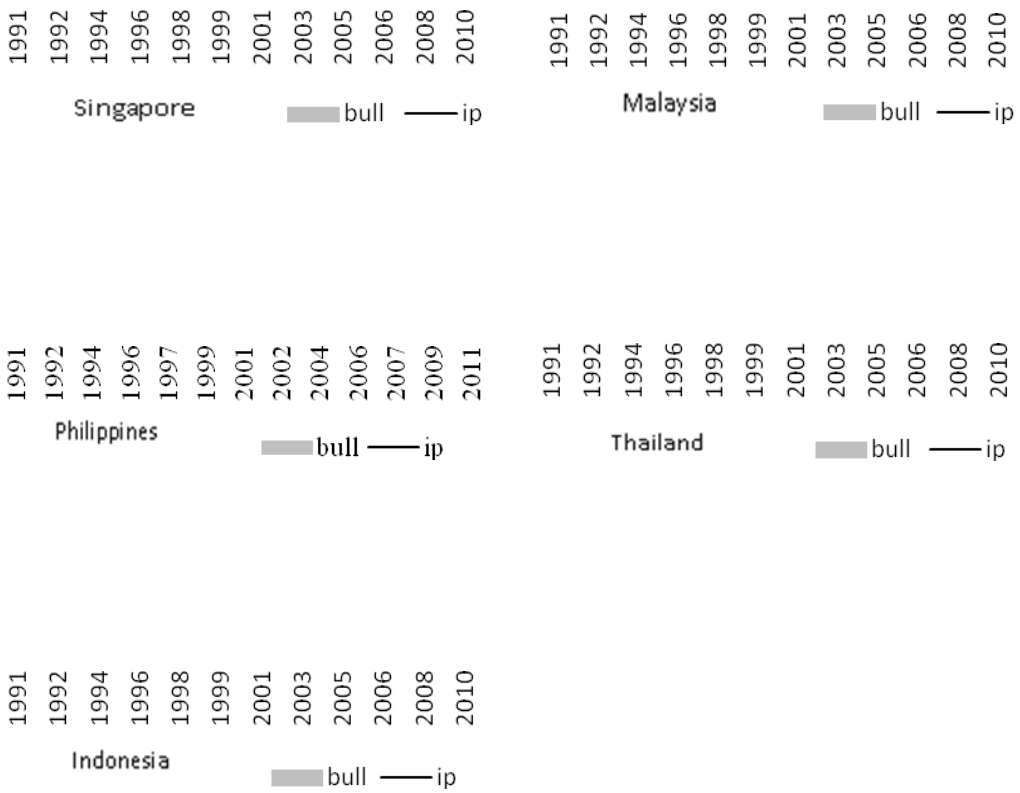
FIGURE 1: The movement of real output (ip) in bull and bear periods of ASEAN-5



Note: The shaded and unshaded areas indicate bull and bear market periods, respectively.

TABLE 1: Markov-switching model of stock returns

	Malaysia	**Indonesia**	**Singapore**	**Thailand**	**Philippines**
μ_1	0.011 (0.003)	0.0189 (0.0047)	0.0088 (0.003)	0.012 (0.005)	0.006 (0.007)
μ_2	-0.009 (0.013)	-0.026 (0.019)	-0.0032 (0.0096)	-0.019 (0.0149)	0.019 (0.077)
σ_1^2	0.0017 (0.0002)	0.0038 (0.0004)	0.0014 (0.0002)	0.0038 (0.0004)	0.007 (0.0002)
σ_2^2	0.012 (0.0017)	0.018 (0.0032)	0.009 (0.0011)	0.017 (0.0025)	0.25 (0.0301)
p^{11}	0.98	0.98	0.96	0.98	0.88
p^{22}	0.95	0.93	0.93	0.95	0.46

State 1 persistency (months)	46.84	58.55	22.63	40.47	8.52
State 2 persistency (months)	20.50	13.96	15.37	18.59	1.84
LogLik	349.76	286.7388	350.9055	266.4885	125.0164

Notes: the entries in the brackets are the standard errors.

FIGURE 2: Smoothed probabilities in state 1 (bull markets)

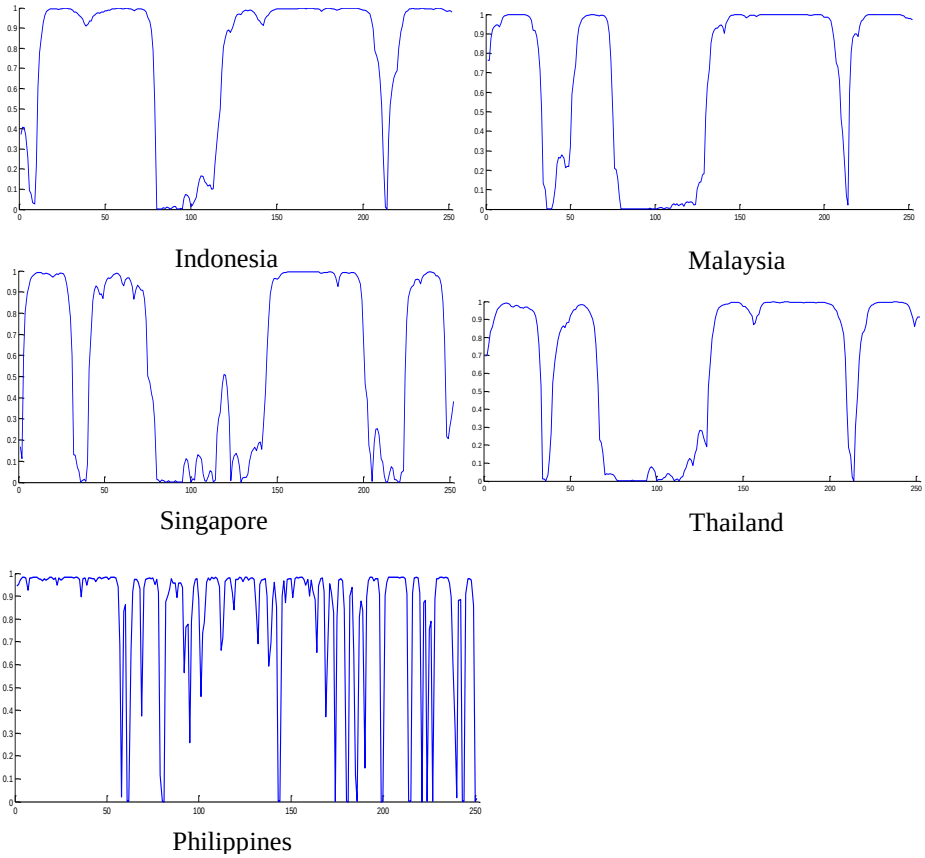


TABLE 3: the PMG estimates of the baseline and augmented models

	Baseline model	Augmented models						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Long run coefficients								
m	-.069 (.01)***	-.068 (.009)***	-.057 (.009)***	-.078 (.01)***	-.058 (.009)** *	-.077 (.009)** *	-.065 (.008)** *	-.068 (.008)** *
lgc	_	.82 (.39)**	_	_	.41 (.39)	.94 (.35)***	_	.54 (.36)
ltrade	_	_	.67 (.22)***	_	.56 (.26)**	_	.66 (.196)** *	.49 (.23)**
inf	_	_		.28 (.12)**	_	.27 (.099)** *	.24 (.086)** *	.24 (.087)** *
Error correction term	-.025 (.006)***	-.028 (.007)***	-.03 (.008)***	-.026 (.007)** *	-.033 (.008)** *	-.029 (.009)** *	-.034 (.01)***	-.034 (.01)***
Hausman test	0.63	_	_	_	_	_	_	_

	(0.43)							
Short run coefficients								
Δm	.009 (.007)	.009 (.008)	.009 (.007)	.009 (.007)	.009 (.008)	.009 (.008)	.01 (.007)	.009 (.008)
Δlgc	_	-.36 (.16)**	_	_	-.34 (.17)**	-.34 (.16)**	_	-.32 (.17)**
$\Delta ltrade$	_	_	-.02 (.04)	_	-.017 (.036)	_	-.02 (.038)	-.017 (.037)
Δinf	_	_	_	-.005 (.002)** *	_	-.006 (.002)** *	-.006 (.002)** *	-.006 (.002)** *
Constant	.12 (.03)***	.19 (.05)***	.15 (.04)***	.12 (.035)** *	.18 (.049)** *	.2 (.06)***	.16 (.05)***	.2 (.06)***

Notes: Dependent variable: natural log of manufacturing production index and policy variable: short-term interest rate. The numbers in parentheses are standard errors except for Hausman test which is p-value. The asterisks ***, **, and * indicate the rejection of null hypothesis at 1%, 5%, and 10% of significance levels, respectively.

TABLE 4: The PMG estimates of model (14) and augmented models. Bull and bear markets are identified using non-parametric approach.

	equation 14	Augmented models						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Long run coefficients								
$mbull$	-.065 (.015)***	-.062 (.013)** *	-.048 (.013)** *	-.077 (.013)** *	-.047 (.014)** *	-.074 (.01)***	-.062 (.01)***	-.063 (.01)***
$mbear$	-.070 (.012)***	-.070 (.01)***	-.057 (.01)***	-.079 (.011)** *	-.059 (.011)** *	-.08 (.01)***	-.066 (.009)** *	-.07 (.01)***
lgc	_	.91 (.44)**	_	_	.53 (.43)	1.03 (.4)***	_	.63 (.4)
$ltrade$	_	_	.76 (.26)***	_	.67 (.29)**	_	.7 (.21)***	.53 (.24)**
inf	_	_	_	.27 (.12)**	_	.28 (.1)***	.24 (.09)***	.25 (.09)***
Error correction term	-.024 (.006)***	-.027 (.007)** *	-.03 (.007)** *	-.025 (.007)** *	-.03 (.007)** *	-.03 (.009)** *	-.03 (.01)***	-.03 (.01)***
Hausman test	2.01 (.3657)	_	_	_	_	_	_	_
Short run coefficients								
$\Delta mbull$	.01 (.008)	.01 (.008)	.01 (.008)	.01 (.008)	.01 (.008)	.01 (.008)	.01 (.008)	.01 (.008)
$\Delta mbear$	.007 (.006)	.007 (.006)	.008 (.006)	.007 (.006)	.008 (.006)	.007 (.006)	.008 (.006)	.008 (.006)
Δlgc	_	-.34 (.17)**	_	_	-.32 (.17)*	-.33 (.17)**	_	-.3 (.17)**
$\Delta ltrade$	_	_	-.02 (.04)	_	-.02 (.03)	_	-.02 (.037)	-.02 (.04)
Δinf	_	_	_	-.005 (.002)** *	_	-.006 (.002)** *	-.006 (.002)** *	-.006 (.002)** *
Constant	.12 (.027)***	.19 (.047)**	.15 (.04)***	.12 (.03)***	.19 (.041)**	.2 (.06)***	.15 (.047)**	.2 (.06)***

		*			*		*	

Notes: See notes of TABLE 3.

TABLE 5: The PMG estimates of model (14) and augmented models. Bull and bear markets are identified using Markov-switching models

	equation 14		Augmented models					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Long run coefficients								
$mbull$	-.069 (.011)***	-.01 (.01)	-.054 (.01)***	-.079 (.01)***	-.056 (.01)***	-.079 (.01)***	-.064 (.01)***	-.067 (.01)***
$mbear$	-.078 (.020)***	-.007 (.004)	-.068 (.02)***	-.082 (.019)***	-.064 (.016)***	-.074 (.016)***	-.069 (.01)***	-.068 (.01)***
lgc	–	.08 (.38)	–	–	.42 (.4)	.97 (.35)***	–	.54 (.4)
$ltrade$	–	–	.77 (.25)***	–	.64 (.28)**		.70 (.21)***	.52 (.23)**
inf	–	–	–	1.42 (.55)***		1.4 (.46)***	.23 (.09)***	.23 (.09)***
Error correction term	-.024 (.006)***	-.03 (.02)**	-.03 (.008)***	-.02 (.007)***	-.03 (.008)***	-.03 (.009)***	-.03 (.01)***	-.03 (.01)***
Hausman test	.027 (0.88)	–	–	–	–	–	–	–
Short run coefficients								
$\Delta mbull$	.01 (.007)	.01 (.007)	.01 (.007)	.01 (.007)	.01 (.007)	.01 (.007)	.01 (.007)	.01 (.007)
$\Delta mbear$	.008 (.008)	.007 (.008)	.009 (.008)	.008 (.008)	.009 (.008)	.008 (.008)	.009 (.008)	.008 (.008)
Δlgc	–	-.33 (.17)**	–	–	-.31 (.17)*	-.33 (.17)**	–	-.31 (.17)*
$\Delta ltrade$	–	–	-.02 (.036)	–	-.02 (.035)	–	-.02 (.04)	-.02 (.04)
Δinf	–	–	–	-.03 (.01)***	–	-.03 (.01)***	-.006 (.002)***	-.006 (.002)***
Constant	.12 (.03)***	.15 (.08)**	.15 (.04)***	.07 (.02)***	.18 (.047)***	.14 (.05)***	.16 (.047)***	.2 (.06)***

Notes: See notes of TABLE 3.