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Indicator for Describing Bull and Bear Markets: Asymmetry and Persistence Perspective

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Abstract

This paper considers the persistent and asymmetric volatility in stock returns at each market phase in the ASEAN-5 countries. The results show that there is a prevalence of asymmetry in both bull and bear markets. Negative shocks are found to increase the volatility of stock market returns more than positive shocks. There exists a high asymmetry in bear markets whereas asymmetry is small to moderate for bull markets. Furthermore, the results suggest strong evidence of persistent volatility in all market phases. The implication for negative asymmetry and high persistence is that during market downturns, stock markets need to be monitored carefully or they should be hedged in order to limit their risk and risk-elevating impact on the inancial system.

Keywords: Stock Return Volatility, Asymmetry, Persistence, An EGARCH model, Bull Market, Bear Market

JEL Classi ication: C22, C58, G10

1. Introduction

This paper deals with the analysis of asymmetry and persistence volatility in the bull and bear phases of the ASEAN5 markets. Since the Great Depression, the world has been experiencing many worse bear markets, and thus the additional study of past bull and bear markets with the aim of making long-term investment decisions is needed. We assume that the classification of financial markets involves bull and bear phases, and each market phase is a regime being driven by certain market forces. These market forces generate bad news provoking panic and causing investors to sell off stocks rapidly. As soon as the bad news ends, markets rebound. Bear markets happen when a series of bad news stories creates pessimism in the mind of the investors who hastily sell off stocks, whereas bull markets happen when a series of good news creates optimism, and they hold stocks.

In term of stock markets periods, a bull market is generally related to increasing market prices whereas a bear market is associated with decreasing market prices. A critical threshold value of the stock market index can be applied as a good indicator to split bull markets from bear markets (Wiggins, 1992). Moreover, empirical evidence reveals that bull markets persist longer than bear markets (Pagan and Sossounov, 2003; Lunde and Timnermann, 2004; Gil-Alana et al., 2014). Since bull markets last longer than bear markets, it is of interest to examine the extent of the persistence based on the estimates of a persistence parameter for the stock market volatility series in each market phase.

As the time period of the two market phases is different, the issue of asymmetry in each market phase becomes relevant. Theoretically, Acemoglu and Scott (1993, 1994) claimed that there are implications of asymmetries in the business cycle. The summary statistics for stochastic behaviour of any variable (e.g. mean, conditional variance, and persistence) should be conditioned on

the state of the business cycle. This is because whenever there is an increase in returns, both agents and the economy respond differently to the same shocks at different stages of the cycle. Therefore, their responses lead to artificial asymmetries that specify each phase of the market. In addition, the importance of negative asymmetric volatility has been widely emphasised in the economics literature. Negative shocks to stock market returns have greater impacts on the unemployment rate than positive shocks (Holmes and Maghrebi, 2016). Bad news of depreciation in the nominal exchange rate trigger foreign currency holdings, which further depreciates the domestic currency exchange rate more than good news of appreciation leads to further appreciation of the nominal exchange rate of domestic currency (Udoh and Udeaja, 2019).

There are many academic papers in the literature identifying bull and bear phases, providing different definitions. Dukes et al. (1987) defined the market phases as periods in which the index increased (decreased) by at least 20% from a trough (peak) to a peak (trough) for the bull (bear) period. Pagan and Sossounov (2003) and Lunde and Timnermann (2004) developed trend-based methodologies to identify market phases, and Pagan and Sossounov (2003) applied an algorithm to detect the market phases. Recently, Gil-Alana et al. (2014) evaluated the degree of persistence and the volatility of stock market indices in the US, Europe, and Asia by using the methodologies based on fractional integration and GARCH approaches. To indicate the bull and bear periods, the model detects the peaks and troughs for each series in the sample. Importantly, the dependency of stock market volatility can be used to indicate stock market conditions. There is a higher degree of the dependence of volatility in bull periods than those in bear periods.

Stock market volatility and its characteristics have been extensively investigated in developed and industrialised countries. Nonetheless, few papers

have studied the implications of stock market volatility for different economic conditions in the ASEAN5. Among the few, Cevik et al. (2016) discover evidence of stock return volatilities (both aggregate market and industry levels) in relation to Southeast Asian economies. Their research uses a dynamic factor model to analyse the data from Indonesia, Malaysia, the Philippines, South Korea, and Thailand from 1995 to 2013. The riskiness in the stock market, banking sector, currency market, sovereign debt, and external debt are included to construct a financial stress index. Empirical evidence suggests that the financial stress index tracks recessions closely in the sample. Furthermore, the results from the impulse response functions indicate that financial stress causes significant economic slowdowns. Arshad and Rizvi (2015) took Malaysia, Indonesia, Singapore, and South Korea into consideration. A wavelet decomposition in conjunction with an EGARCH (exponential generalised autoregressive conditional heteroskedasticity) model is employed to obtain short-term and long-term volatilities of stock market returns. They find that the stock markets are more stable during an economic boom than the preceding bust. Another academic paper from the ASEAN5 is Zare et al. (2013) who demonstrated that stock market volatility in bear markets is more strongly affected by a contractionary monetary policy than bulls.

Even though the linkage between stock market volatility and economic activities has been found, there is no study focusing on asymmetric and persistent volatility to indicate bull and bear markets in the ASEAN5. Additionally, each market is often separated in the research according to the classification of developed and emerging stock markets (Indonesia, Malaysia, the Philippines, and Thailand are considered emerging markets, whereas Singapore is considered a developed market). A closely related study is the work of Horpestad et al. (2019) who study asymmetric volatility in developed stock markets around the world (including Singapore). The asymmetry is explored for forecast improvements of stock market volatility, and the results exhibit an asymmetric volatility effect

that is stronger in the US and European market indices than in Latin America, Asia, and Australia. Furthermore, the authors find that the volatility forecasting models that allow for asymmetry fit the data better than their symmetric counterparts. Importantly, the largest forecast improvement of asymmetric volatility models is when markets are subject to extreme volatility. Todea (2016) analyse the data from twenty emerging stock markets including Indonesia, Malaysia, the Philippines, and Thailand. Cross-correlations between volatility, volatility persistence, and stock market integration are uncovered. Stronger volatility and volatility persistence have been found in markets, which are more integrated.

It is unclear how asymmetry and persistence of stock return volatility can be used as an indication for bull and bear phases in the ASEAN5 and whether the implications are similar to other emerging stock markets and/or developed markets. This enables us to bring further evidence for the ASEAN-5 countries. Moreover, this paper will add some clarification of five stock markets regarding how they can develop to be less volatile, more stable, and more efficient. Consequently, the improvements will be advantageous to local and global investors.

In this paper, we endeavour further to assess stock market volatility taking Indonesia, Malaysia, the Philippines, Thailand, and Singapore, owing to their economic and financial development. We investigate asymmetric and persistent volatility of the ASEAN5 not only in the context of stock market conditions but also among developed and emerging markets for diversification benefit. To this end, we use recent time-series data for the period of 1995-2017, applying unit root tests to check for further changes in volatility dynamics. Next, we apply an appropriate econometric specification based on an EGARCH model to capture the long memory and leverage effect. This paper results in two interesting findings. Firstly, it is found that stock return volatility displays an

apparent asymmetric response to shocks, which have much more pronounced and permanent effects during unstable periods than during stable periods. Such effects should be taken into account whenever volatility modelling of stock returns is considered, particularly during periods of volatile prices. Secondly, we show that stock return volatility in the Philippines and Thailand is more persistent in bull markets than that in bears, whereas a high persistent volatility has been generally found more in bear markets than in bulls for Indonesia, Malaysia, and Singapore. This suggests that the Filipino and Thai stock markets escape the financial downturn faster than the others.

The remainder of this paper is organised as follows: Section 2 explains the rationale for using econometric methodology, and the empirical results are presented in Section 3. Section 4 accommodates a summary of findings, a discussion of their meaning, and the contributions and policy implications in our paper.

2. Econometric methodology

We use an Exponential Generalised Auto-Regressive Conditional Heteroskedasticity (EGARCH) model, which was originated by Nelson (1991), to measure stock return volatility. The EGARCH model is one of several models proposed to ease the symmetric restriction of the standard GARCH model. The model has been widely used in empirical studies as asymmetric GARCH models can catch asymmetric effects of conditional variance on the excess return (Jiranyakul, 2011). Importantly, non-negativity constraints on the coefficients in the conditional variance equation are not imposed in this model. Secondary data, the daily closing stock market index, is used to calculate daily returns, which are defined as the change in the log of the stock price index. Suppose P_{t-1} and P_t denote the values of the stock market index in day t-1 and t, respectively.

The return in period t: $R_t = 100*\log(P_t) - \log(P_{t-1})$ (1)

The daily return is used to calculate its volatility by an exponential GARCH (EGARCH) model. We specify the mean equation with a simple constant, where $\log(P_t) - \log(P_{t-1})$ is he continuously compounding return:

$$\log(P_t) - \log(P_{t-1}) = c_1 + \varepsilon_t \quad (2)$$

For the variance specification, we employ an EGARCH (1, 1) model:

$$\log(\sigma_{t+1}^2) = \omega + \alpha\left|\frac{\varepsilon t}{\sigma t}\right| + \gamma\frac{\varepsilon t}{\sigma t} + \beta\log(\sigma_t^2), \quad (3)$$

where σ_t^2 is known as the conditional variance at time t.

ω is the constant coefficient.

α represents a magnitude effect or the symmetric effect of the model, the "ARCH" effect.

γ measures the asymmetry or the leverage effect that the EGARCH model uses to allow for the testing of asymmetries. If $\gamma = 0$, then the model is symmetric. When $\gamma < 0$, then negative shocks (bad news) generate more volatility than positive shocks (good news). When $\gamma > 0$, it implies that positive innovations are more destabilising than negative innovations.

β measures the persistence in conditional volatility irrespective of anything happening in the market, the 'GARCH' effect. When β is relatively large, then volatility takes a long time to die out.

The EGARCH model is mainly used to analyse financial data, and its efficacy has been proven in estimating the volatility in emerging markets. Statistically, emerging market volatility denotes a strong asymmetric effect, which can be detected through the EGARCH. Alberg et al. (2008) explored that the asymmetric GARCH model with a fat-tailed density improved the overall estimation for conditional variance. They revealed that the EGARCH skewed

Student's t-model is the most promising for characterising the dynamic behaviour of returns as it reflects the return's underlying process in terms of asymmetric volatility, clustering, leptokurtic innovation, and serial correlation. Therefore, the EGARCH skewed Student's t-model outperforms other GARCH-type models (GARCH, GJR, and APARCH models) in emerging markets. For these reasons, we apply the EGARCH model in our analysis. In other words, the EGARCH model applied is adequate for capturing all three elements of stock return volatility: the magnitude effect, the asymmetry or leverage effect, and the persistence in conditional volatility. It is also important to note that any other asymmetric GARCH specification could be chosen and would have been adequate for this task. However, the focus of this paper is not on choosing the most suitable asymmetric GARCH model for determining bull and bear markets.

Our test results from a diagnostic checking of the EGARCH model (Tables 12-16) shows the results in all five countries. More specifically, we apply three lags for ARCH tests to avoid misjudgment that the model is wrong by relying on a particular timing of the change of variance. If the irregularities are serious, the test statistics will be significant for all three lags applied, and then we can be reasonably confident that the model is misspecified and the results will be biased. For the heteroskedasticity test, we cannot reject the null hypothesis that the residual has no ARCH effect at the 5% level of significance. This is a desirable outcome as it indicates that homoskedasticity occurs in the models. Therefore, it is reasonable to apply the EGARCH model in our analysis.

To complete the basic GARCH specification, we require an assumption about the conditional distribution of the error term. Although a normal (Gaussian) distribution has been exclusively used, all of the examples illustrated so far have the well-known fat tails in the return series and are more appropriate. A distribution that has fatter tails than the normal distribution should be used, and

the two most common fat-tailed error distributions for fitting GARCH models are the Student's t-distribution and the generalised error distribution (GED). Bollerslev (1987) proposed fitting a GARCH model with a Student's t-distribution for the standardised residual whereas Nelson (1991) proposed to use the GED to capture the fat tails, which are usually observed in the distribution of financial time series. Even though Nelson's original EGARCH model assumed the GED, the EGARCH with the student's t-model outperforms other distributional assumptions (Alberg et al., 2008). More importantly, return distributions in all five countries exhibit asymmetry, the leptokurtic effect, and longer tails, either on the right or left, than normal distribution patterns (the results are shown in Tables 7-11). To deal with a return series associated with non-normality in the matter concerning leptokurtosis, the assumption of the Student's t-distribution has been widely applied in empirical studies (Baillie and Bollerslev, 1989; Beine et al., 2002; Chuang et al., 2012; Jayasinghe et al., 2014). Thus, for our analysis, the selection of the Student's t-distribution is assumed in the EGARCH model.

3. Empirical results

3.1. Data and preliminary analysis

This paper deals with the analysis of asymmetry and persistence of stock return volatility in ASEAN5 markets including four emerging stock markets: Indonesia (Jakarta Stock Exchange Composite Index: JKSE), Malaysia (Kuala Lumpur Stock Exchange Composite Index: KLSE), the Philippines (The Philippine Stock Exchange Index: PSE) and Thailand (Stock Exchange of Thailand Index: SET); and one developed stock market: Singapore (Straits Times Index: STI). The stock price index in each country is a modified capitalisation-weighted index of all stocks listed on the regular board of the stock exchange. All estimations

are carried out using the data from January 1995 to December 2017 (6,000 observations) obtained from DataStream.

3.2 The identification of market phases

The return series of stock markets in the ASEAN-5 countries are reported in Figures 1-5 with three remarks. First, stock market returns show excess volatility that varies significantly by country under consideration but is more significant in times of crisis periods than in tranquil periods. Second, the volatility excess seems to have been significantly and differently persistent in the time of tranquil and crisis periods. Third, stock market returns are characterised by significant shifts, suggesting further evidence of breaks in volatility, notably during crisis periods. In addition, stock market returns respond significantly to the Asian financial crisis, which began in mid-1997 and continued until around 1999. It is also evident that the subprime crisis in 2007-2009 is characterised by an upswing in stock market returns. This informal discussion does not lead us to reject the hypothesis that the stock return volatility might have a meaningful relationship for the movements in different market conditions.

The procedure given in Pagan and Sossounov (2003) is employed to split the series into bull and bear phases. It is presented as follows:

(1a) Determine the initial turning points in raw data by choosing local peaks (troughs) as occurring when they are the highest (lowest) values in a window of eight months on either side of the date.

(1b) Enforce the alternation of turns by selecting the highest of the multiple peaks (or the lowest of the multiple troughs).

(2a) Eliminate turns within six months of the beginning and end of the series.

(2b) Eliminate peaks (or troughs) at both ends of the series which are lower or higher.

(2c) Eliminate cycles whose duration is less than 16 months.

(2d) Eliminate phases whose duration is less than four months (unless fall or rise exceeds 20%).

Based on these steps, the final turning points (peaks and troughs) are identified and the bull and bear periods are determined accordingly. The turning points, denoted as trough (T) and peak (P), are identified in Figures 1-5. The dates of each period are presented in Table 1. The start and end points were taken as peaks, and in fact, the time plot supports that. We obtain eleven market phases for Indonesia and Malaysia, fifteen phases for the Philippines, nineteen phases for Thailand, and seventeen phases for Singapore. Presently, all stock markets are still in their bullish states. Thailand shows the highest number of troughs and peaks, implying that it has the shortest time period for each market phase. Thailand would probably have the shortest persistence time of stock market conditions. Moreover, we found that the longest market phases for most countries (Indonesia, the Philippines, and Singapore) are in the period before the subprime crisis, and during the crisis in Malaysia. More significantly, all the longest periods are in bull phases. On the other hand, the results from Indonesia, the Philippines, and Thailand show that the shortest periods have been found in the post-subprime crisis. The shortest periods are in bear phases for most countries except for Singapore.

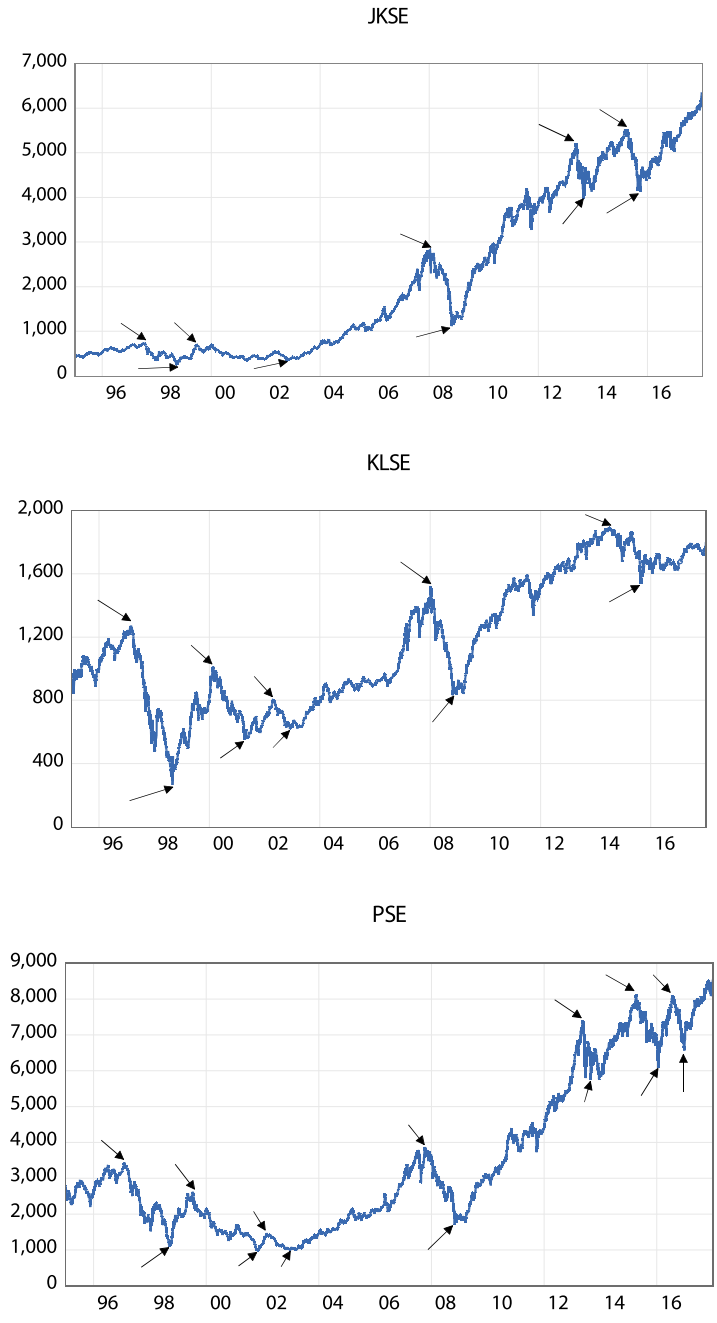
3.3 Unit root tests

For an empirical investigation, we first employ the testing of unit roots of each series to evaluate whether the variable is stationary. A non-stationary time series has a different mean at different points in time, and its variance increases

with the sample size (Harris and Sollis, 2003). The feature of a non-stationary time series is crucial because any linear combinations of non-stationary can make for a spurious regression. When this occurs, *t*-values of the coefficients are highly significant, coefficient of determination (R^2) is very close to one, and value of the Durbin Watson (DW) statistic is very low, regularly leading investigators to commit a high frequency of Type 1 errors (Granger and Newbold, 1974). As a result, the estimation of coefficients becomes biased. Hence, it is necessary to detect the existence of non-stationarity or stationarity in the series in order to avoid the problem of spurious regression. The Augmented Dickey-Fuller (ADF) (1979) test considered here evaluates the null hypothesis that the data follow a unit root process against a stationary trend. If the null hypothesis is rejected, the variable is generated by a stationary process.

The results of the unit root test of stock return volatilities in five countries are demonstrated in Tables 2-6. The ADF test statistics at level $I(0)$ and the first difference $I(1)$ are based on a standard regression including an intercept with a linear trend. This investigation focuses on the intercept and trend because it is complete compared to using the intercept or trend only (Hacker and Hatemi, 2009). Generally, the ADF test fails to reject the null hypothesis of the existence of a unit root at level $I(0)$ of stock market volatility in bear markets, but it rejects the same hypothesis in the first difference $I(1)$ of all data series. Non-stationary time series imply that stock markets tend to fluctuate more in bear markets than in bull markets, which for longer series, is often far from a historical average. Non-stationary series usually have a trend (stock market volatility in level).

Figures 1-5: Time series plot of daily stock market indices in the ASEAN-5 countries (1995–2017)



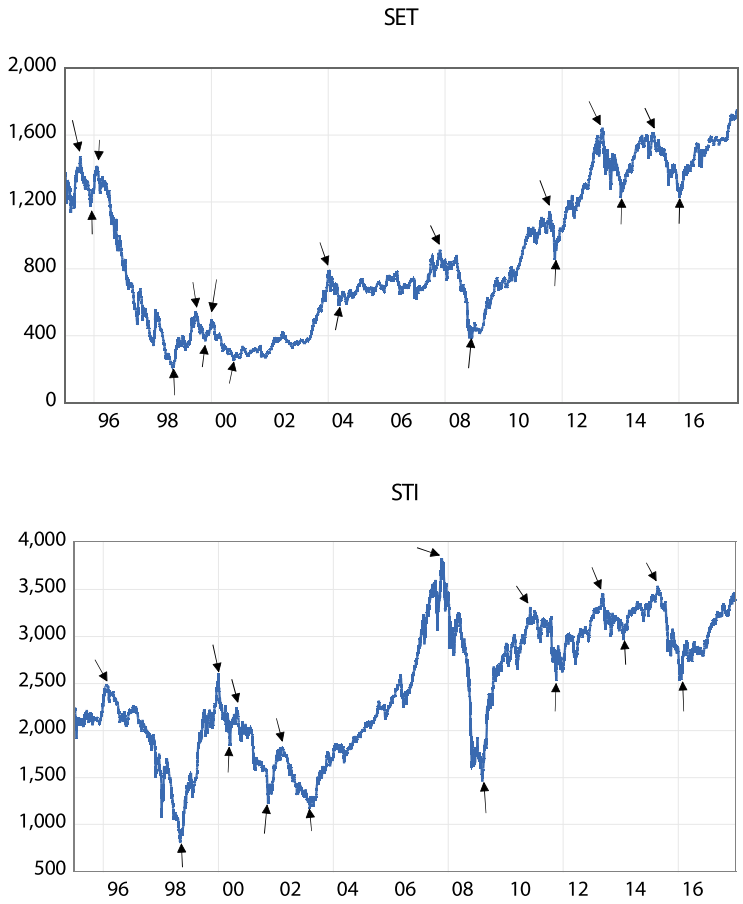

SET
2,000
1,600
1,200
800
400
0
96
98
00
02
04
06
08
10
12
14
16
STI
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
96
98
00
02
04
06
08
10
12
14
16

Table 1: ASEAN-5 bull and bear market phases

Phases	Market	Indonesia	Malaysia	Philippines	Thailand	Singapore
1st	Bull	1/1/1995 - 8/7/1997	1/1/1995 - 28/2/1997	1/1/1995 - 3/2/1997	1/1/1995 - 10/7/1995	1/1/1995 - 6/2/1996
2nd	Bear	9/7/1997 - 21/9/1998	29/2/1997 - 1/9/1998	4/2/1997 - 11/9/1998	11/7/1995 - 16/11/1995	7/2/1996 - 4/9/1998
3rd	Bull	22/9/1998 - 21/6/1997	2/9/1998 - 18/2/2000	12/9/1998 - 5/7/1999	17/11/1995 - 6/2/1996	5/9/1998 - 3/1/2000
4th	Bear	22/6/1997 - 14/10/2002	19/2/2000 - 9/4/2001	6/7/1999 - 24/10/2001	7/2/1996 - 4/9/1998	4/1/2000 - 30/5/2000
5th	Bull	15/10/2002 - 9/1/2008	10/4/2001 - 23/4/2002	25/10/2001 - 19/2/2002	5/9/1998 - 22/6/1999	31/5/2000 - 22/8/2000
6th	Bear	10/1/2008 - 28/10/2008	24/4/2002 - 3/12/2002	20/2/2002 - 19/12/2002	23/6/1999 - 21/10/1999	23/8/2000 - 21/9/2001
7th	Bull	29/10/2008 - 20/5/2013	4/12/2002 - 11/1/2008	20/12/2002 - 8/10/2007	22/10/1999 - 4/1/2000	22/9/2001 - 19/3/2002
8th	Bear	21/5/2013 - 27/8/2013	12/1/2008 - 29/10/2008	9/10/2007 - 28/10/2008	5/1/2000 - 11/10/2000	20/3/2002 - 10/3/2003
9th	Bull	28/8/2013 - 7/4/2015	30/10/2008 - 24/6/2014	29/10/2008 - 15/5/2013	12/10/2000 - 12/1/2004	11/3/2003 - 11/10/2007
10th	Bear	8/4/2015 - 28/9/2015	25/6/2014 - 24/8/2015	16/5/2013 - 28/8/2013	13/1/2004 - 17/5/2004	12/10/2007 - 9/3/2009
11th	Bull	29/9/2015 - 31/12/2017	25/8/2015 - 31/12/2017	29/8/2013 - 10/4/2015	18/5/2004 - 29/10/2007	10/3/2009 - 9/11/2010
12th	Bear			11/4/2015 - 21/1/2016	30/10/2007 - 29/10/2008	10/11/2010 - 5/10/2011
13th	Bull			22/1/2016 - 21/7/2016	30/10/2008 - 1/8/2011	6/10/2011 - 22/5/2013
14th	Bear			22/7/2016 - 23/12/2016	2/8/2011 - 4/10/2011	23/5/2013 - 5/2/2014
15th	Bull			24/12/2016 - 31/12/2017	5/10/2011 - 21/5/2013	6/2/2014 - 15/4/2015
16th	Bear				22/5/2013 - 3/1/2014	16/4/2015 - 21/1/2016
17th	Bull				4/1/2014 - 13/2/2015	22/1/2016 - 31/12/2017
18th	Bear				14/2/2015 - 7/1/2016	
19th	Bull				8/1/2016 - 31/12/2017	

Therefore, they also have a trend in their mean and variance. All in all, stock market volatility in all five countries do not appear to have a unit root at the first difference *I*(1) when they are plotted against time, at least not over the past 23 years. In general, the evidence does favour the existence of stationary. Notably, the results of non-stationary data in level, but stationary data in the first difference are consistent with the work of Fakhfekh et al. (2016). We perform further analyses for asymmetrical effects and persistence by applying an EGARCH model.

Table 2: Unit root test: Indonesia

At level *I(o)*	ADF Test Statistic	Test critical values			P-value
		1% level	5% level	10% level	
Bull	-15.952	-3.972	-3.417	-3.131	0.000
Bear	-5.180	-3.988	-3.424	-3.135	0.000
Bull	-11.129	-4.006	-3.433	-3.140	0.000
Bear	-10.590	-3.969	-3.415	-3.130	0.000
Bull	-7.244	-3.965	-3.413	-3.129	0.000
Bear	0.122	-4.003	-3.432	-3.139	0.997
Bull	-5.765	-3.966	-3.414	-3.129	0.000
Bear	-4.129	-4.095	-3.475	-3.165	0.009
Bull	-5.057	-3.980	-3.421	-3.133	0.000
Bear	-3.097	-4.036	-3.447	-3.149	0.112
Bull	-4.227	-3.974	-3.417	-3.131	0.004
1st Difference *I(1)*					
Bull	-12.851	-3.972	-3.417	-3.131	0.000
Bear	-7.162	-3.989	-3.425	-3.135	0.000
Bull	-7.746	-4.008	-3.434	-3.141	0.000
Bear	-13.619	-3.969	-3.415	-3.130	0.000

Bull	-17.065	-3.965	-3.413	-3.129	0.000
Bear	-14.270	-4.003	-3.432	-3.140	0.000
Bull	-11.919	-3.966	-3.414	-3.129	0.000
Bear	-9.313	-4.097	-3.476	-3.166	0.000
Bull	-4.478	-3.981	-3.421	-3.133	0.002
Bear	-5.775	-4.038	-3.448	-3.149	0.000
Bull	-23.158	-3.974	-3.417	-3.131	0.000

Table 3: Unit root test: Malaysia

At level *I(o)*	ADF Test Statistic	Test critical values			P-value
		1% level	5% level	10% level	
Bull	-3.640	-3.975	-3.418	-3.131	0.027
Bear	-2.834	-3.982	-3.421	-3.133	0.186
Bull	-6.090	-3.983	-3.422	-3.134	0.000
Bear	-3.422	-3.989	-3.425	-3.136	0.050
Bull	-5.951	-3.993	-3.427	-3.137	0.000
Bear	-2.223	-4.020	-3.440	-3.144	0.473
Bull	-5.580	-3.965	-3.413	-3.129	0.000
Bear	-1.798	-4.003	-3.432	-3.140	0.703
Bull	-9.483	-3.964	-3.413	-3.128	0.000
Bear	1.298	-3.989	-3.425	-3.136	1.000
Bull	-6.526	-3.973	-3.417	-3.131	0.000
1st Difference *I(1)*					
Bull	-10.736	-3.975	-3.418	-3.131	0.000
Bear	-7.865	-3.982	-3.422	-3.134	0.000
Bull	-12.558	-3.983	-3.422	-3.134	0.000
Bear	-18.147	-3.990	-3.425	-3.136	0.000
Bull	-7.684	-3.994	-3.427	-3.137	0.000

Bear	-5.258	-4.020	-3.440	-3.144	0.000
Bull	-11.151	-3.965	-3.413	-3.129	0.000
Bear	-13.677	-4.003	-3.432	-3.140	0.000
Bull	-12.540	-3.964	-3.413	-3.128	0.000
Bear	-15.926	-3.989	-3.425	-3.135	0.000
Bull	-10.942	-3.973	-3.417	-3.131	0.000

Table 4: Unit root test: Philippines

At level *I(o)*	**ADF Test Statistic**	**Test critical values**			**P-value**
		1% level	**5% level**	**10% level**	
Bull	-3.094	-3.975	-3.418	-3.132	0.109
Bear	-4.603	-3.980	-3.421	-3.133	0.001
Bull	-2.933	-4.004	-3.432	-3.140	0.155
Bear	-6.248	-3.973	-3.417	-3.131	0.000
Bull	-4.683	-4.075	-3.466	-3.160	0.002
Bear	-8.391	-4.002	-3.431	-3.139	0.000
Bull	-7.059	-3.965	-3.413	-3.129	0.000
Bear	5.428	-3.993	-3.427	-3.137	1.000
Bull	-8.788	-3.966	-3.414	-3.129	0.000
Bear	-1.104	-4.093	-3.474	-3.164	0.921
Bull	-4.403	-3.981	-3.421	-3.133	0.002
Bear	-6.048	-4.004	-3.432	-3.140	0.000
Bull	-7.797	-4.031	-3.445	-3.147	0.000
Bear	-4.661	-4.048	-3.453	-3.152	0.001
Bull	-21.117	-3.993	-3.427	-3.137	0.000
1st Difference *I(1)*					
Bull	-9.396	-3.975	-3.418	-3.132	0.000
Bear	-20.484	-3.980	-3.421	-3.133	0.000

Bull	-7.310	-4.003	-3.432	-3.140	0.000
Bear	-10.808	-3.974	-3.417	-3.131	0.000
Bull	-6.329	-4.082	-3.469	-3.162	0.000
Bear	-8.716	-4.003	-3.432	-3.140	0.000
Bull	-15.873	-3.965	-3.413	-3.129	0.000
Bear	-4.342	-3.993	-3.427	-3.137	0.003
Bull	-14.593	-3.966	-3.414	-3.129	0.000
Bear	-6.202	-4.093	-3.474	-3.164	0.000
Bull	-6.862	-3.981	-3.421	-3.133	0.000
Bear	-7.601	-4.006	-3.433	-3.140	0.000
Bull	-4.000	-4.038	-3.448	-3.149	0.011
Bear	-9.392	-4.044	-3.452	-3.151	0.000
Bull	-9.310	-3.995	-3.428	-3.137	0.000

Table 5: Unit root test: Thailand

At level *I(o)*	ADF Test Statistic	Test critical values			P-value
		1% level	5% level	10% level	
Bull	-9.958	-4.028	-3.444	-3.147	0.000
Bear	-2.848	-4.061	-3.459	-3.156	0.184
Bull	-10.630	-4.127	-3.491	-3.174	0.000
Bear	-5.193	-3.972	-3.417	-3.131	0.000
Bull	-17.281	-4.003	-3.432	-3.140	0.000
Bear	-2.996	-4.068	-3.463	-3.158	0.139
Bull	-4.106	-4.186	-3.518	-3.190	0.012
Bear	-4.952	-4.006	-3.433	-3.140	0.000
Bull	-6.429	-3.969	-3.415	-3.130	0.000
Bear	-2.529	-4.066	-3.462	-3.157	0.314
Bull	-10.212	-3.968	-3.415	-3.130	0.000

Bear	2.416	-3.995	-3.428	-3.137	1.000
Bull	-5.585	-3.971	-3.416	-3.130	0.000
Bear	-3.089	-4.176	-3.513	-3.187	0.121
Bull	-4.286	-3.980	-3.421	-3.133	0.004
Bear	-11.918	-4.016	-3.438	-3.143	0.000
Bull	-3.112	-3.991	-3.426	-3.136	0.105
Bear	-29.886	-3.998	-3.429	-3.138	0.000
Bull	-3.972	-3.976	-3.419	-3.132	0.010
1st Difference *I(1)*					
Bull	-8.347	-4.032	-3.446	-3.148	0.000
Bear	-10.321	-4.062	-3.460	-3.156	0.000
Bull	-5.591	-4.161	-3.506	-3.183	0.000
Bear	-13.323	-3.972	-3.417	-3.131	0.000
Bull	-7.920	-4.006	-3.433	-3.140	0.000
Bear	-9.857	-4.070	-3.464	-3.158	0.000
Bull	-3.797	-4.199	-3.524	-3.193	0.027
Bear	-11.603	-4.005	-3.433	-3.140	0.000
Bull	-11.781	-3.969	-3.415	-3.130	0.000
Bear	-7.687	-4.066	-3.462	-3.157	0.000
Bull	-13.788	-3.968	-3.415	-3.130	0.000
Bear	-6.737	-3.995	-3.428	-3.137	0.000
Bull	-12.865	-3.971	-3.416	-3.130	0.000
Bear	-4.842	-4.199	-3.524	-3.193	0.002
Bull	-7.802	-3.980	-3.421	-3.133	0.000
Bear	-9.192	-4.018	-3.439	-3.144	0.000
Bull	-9.630	-3.991	-3.426	-3.136	0.000
Bear	-8.497	-4.000	-3.430	-3.139	0.000
Bull	-12.717	-3.976	-3.419	-3.132	0.000

Table 6: Unit root test: Singapore

At level *I(o)*	ADF Test Statistic	Test critical values			P-value
		1% level	5% level	10% level	
Bull	-3.320	-3.991	-3.426	-3.136	0.065
Bear	-5.252	-3.972	-3.417	-3.131	0.000
Bull	-5.709	-3.985	-3.423	-3.134	0.000
Bear	-2.836	-4.058	-3.458	-3.155	0.188
Bull	-3.614	-4.137	-3.495	-3.177	0.038
Bear	-2.474	-3.991	-3.426	-3.136	0.341
Bull	-3.669	-4.032	-3.446	-3.148	0.028
Bear	-2.245	-3.995	-3.428	-3.137	0.462
Bull	-4.624	-3.966	-3.414	-3.129	0.001
Bear	-3.123	-3.984	-3.422	-3.134	0.103
Bull	-3.116	-3.979	-3.420	-3.133	0.104
Bear	-1.409	-3.998	-3.429	-3.138	0.856
Bull	-4.128	-3.980	-3.421	-3.133	0.006
Bear	-3.702	-4.012	-3.436	-3.142	0.025
Bull	-8.703	-3.988	-3.424	-3.135	0.000
Bear	-2.185	-4.005	-3.433	-3.140	0.495
Bull	-6.504	-3.977	-3.419	-3.132	0.000
1st Difference *I(1)*					
Bull	-10.481	-3.991	-3.426	-3.136	0.000
Bear	-9.106	-3.972	-3.417	-3.131	0.000
Bull	-18.151	-3.985	-3.423	-3.134	0.000
Bear	-4.208	-4.059	-3.458	-3.155	0.006
Bull	-8.667	-4.124	-3.489	-3.173	0.000
Bear	-7.847	-3.991	-3.426	-3.136	0.000
Bull	-13.015	-4.033	-3.446	-3.148	0.000

Bear	-9.564	-3.995	-3.428	-3.137	0.000
Bull	-16.361	-3.966	-3.414	-3.129	0.000
Bear	-8.116	-3.984	-3.423	-3.134	0.000
Bull	-10.233	-3.979	-3.420	-3.133	0.000
Bear	-14.407	-3.998	-3.429	-3.138	0.000
Bull	-6.437	-3.980	-3.421	-3.133	0.000
Bear	-3.430	-4.011	-3.436	-3.142	0.051
Bull	-8.908	-3.989	-3.425	-3.136	0.000
Bear	-12.885	-4.005	-3.433	-3.140	0.000
Bull	-5.691	-3.977	-3.419	-3.132	0.000

3.4 Assessing for asymmetrical effects

In the next step, we compute the main descriptive statistics for five countries and report them in Table 7-11. We can note several interesting results. In all five countries, the mean returns have been found to be positive in all bull markets, and the negative mean returns have been found in all bear markets. The riskiest phases, as measured by the standard deviation (unconditional volatility), are in the bear phases for four stock markets except for Thailand. Not surprisingly, all these riskiest phases are associated with the Asian financial crisis and subprime crisis. In most of the time periods considered, the distributions of return series in all five countries are leptokurtic, suggesting fat tails in the return distributions. This leptokurtic excess property indicates the presence of high risk in the extreme tails of return distributions. Interestingly, using a hypothesis test to compare leptokurtic excess for bull and bear phases, we observed that risk intensity is virtually the same in both conditions of stock markets. Furthermore, we found negative skewness of return distributions for most phases in four countries (Indonesia, Malaysia, the Philippines, and Singapore), which indicates that these returns are asymmetric to the left. The highest negative skewness

values have been found during bear periods. This result can be explained by the fact that during this period, stock market returns were characterised by a significant decrease. Skewness is nonetheless fairly positive for Thailand, suggesting asymmetry to the right for the return distributions, probably due to the fact that during the last twenty-three years, stock market returns were generally positive. Overall, return distributions in all five countries seem to exhibit more asymmetry, leptokurtic effect, and longer tails, either on the right or on the left, than normal distribution patterns. Thus, in order to model volatility dynamics for capturing the ARCH effect, asymmetry, and volatility clustering in stock market returns, we estimated an EGARCH model for further analysis.

3.5 Volatility modelling with an EGARCH model

Tables 12-16 show the main econometric results associated with the estimation of an EGARCH (1, 1) model over the two different market phases.

3.5.1 Cluster patterns (the size effect)

Volatility clustering is said to exist when high (low) stock market volatility in a given period is followed by high (low) volatility in subsequent periods. It is important for regulators and investors alike to understand the volatility clustering patterns because timing and duration of volatility clusters can significantly alter the value of investments and, consequently, affect the ability to manage the shifts in volatility and assessment of risk. We examine the effects of clustering on stock market volatility within the generalised framework and find that the clustering parameter (α) is positive and significant for most of the time period considered. This reflects the presence of a size effect, as the term α shows the size of the surprise. It follows that, in most cases, larger shocks to returns, regardless of their signs, will increase the stock market volatility to a greater extent than smaller shocks, and high (low) volatility in a given period will be followed by high (low) volatility in subsequent periods.

The high α values pertain to stock market volatility in bear periods of Indonesia, the Philippines, and Thailand, indicating that the bear phases are subject to stronger clustering tendencies.

Table 7: The descriptive statistics of return series in Indonesia

	Bull	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**
Mean	0.069	-0.337	0.526	-0.087	0.156	-0.447	0.130	-0.385	0.079	-0.236	0.074
Median	0.028	-0.229	0.000	0.000	0.102	0.000	0.081	0.000	0.072	-0.071	0.057
Max	5.654	13.128	10.707	5.355	6.734	7.623	7.362	3.750	4.544	4.451	3.179
Min	-4.235	-12.732	-8.103	-10.934	-7.800	-10.954	-9.300	-5.746	-3.214	-4.053	-4.088
S.D.	0.873	2.923	2.545	1.532	1.270	2.292	1.333	1.782	0.914	1.150	0.773
Skewness	0.138	0.134	0.963	-0.523	-0.531	-1.064	0.090	-0.337	0.216	-0.287	-0.178
Kurtosis	7.291	6.231	5.772	7.034	7.432	7.505	9.285	3.473	6.142	5.773	6.395
J.B	505	138	93	626	1,183	216	1,958	2	176	41	286
Prob.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.367	0.000	0.000	0.000
Obs.	656	314	195	865	1367	209	1189	71	420	124	589

Table 8: The descriptive statistics of return series in Malaysia

	Bull	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**
Mean	0.048	-0.402	0.352	-0.204	0.140	-0.169	0.068	-0.290	0.056	-0.069	0.026
Median	0.000	-0.401	0.045	-0.188	0.081	-0.076	0.047	-0.145	0.024	-0.014	0.000
Max	5.039	20.817	20.259	3.255	4.503	2.549	4.259	3.375	4.055	1.622	2.222
Min	-4.038	-14.242	-24.153	-6.342	-5.670	-2.430	-4.746	-9.979	-2.531	-2.738	-2.340
S.D.	0.977	2.806	2.623	1.276	1.096	0.783	0.714	1.359	0.624	0.612	0.500
Skewness	0.459	1.120	-0.115	-0.757	-0.662	-0.043	-0.272	-1.814	0.280	-0.601	0.232
Kurtosis	6.846	14.295	33.641	6.699	8.997	4.309	7.871	14.864	6.812	5.095	5.770
J.B	367	2166	14984	197	426	11	1334	1334	912	74	202
Prob.	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000
Obs.	564	392	383	296	271	160	1333	208	1474	304	614

Table 9: The descriptive statistics of return series in the Philippines

	Bull	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**
Mean	0.038	-0.277	0.419	-0.164	0.483	-0.178	0.108	-0.297	0.124	-0.338	0.082	-0.142	0.220	-0.190	0.100
Median	0.000	-0.178	0.460	-0.103	0.268	-0.142	0.000	-0.057	0.039	0.000	0.051	0.000	0.182	-0.181	0.023
Max	3.421	9.666	7.584	16.178	4.109	3.319	9.365	7.056	5.852	5.542	3.530	2.551	3.576	2.853	2.788
Min	-5.846	-9.744	-7.748	-6.191	-2.096	-4.166	-8.251	-13.089	-5.266	-6.989	-2.991	-6.939	-2.440	-2.921	-2.066
S.D.	1.079	2.081	2.078	1.575	1.176	1.019	1.233	1.871	1.152	2.085	0.812	1.072	1.035	1.058	0.740
Skewness	-0.289	0.248	-0.193	3.126	0.580	-0.145	-0.023	-1.555	-0.031	-0.621	-0.030	-1.537	0.361	0.032	0.283
Kurtosis	5.353	6.912	4.911	36.997	3.628	4.662	8.448	12.335	5.992	4.427	5.064	11.131	3.801	3.355	4.003
J.B	133	271	33	29971	6	26	1549	1113	442	11	75	642	6	1	15
Prob.	0.000	0.000	0.000	0.000	0.047	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.043	0.740	0.001
Obs.	545	419	211	602	84	217	1252	276	1186	75	422	204	130	111	265

Table 10: The descriptive statistics of return series in Thailand

	Bull	Bear	Bull	Bear	Bull	Bear	Bull	Bear	Bull
Mean	0.059	-0.243	0.321	-0.285	0.468	-0.456	0.576	-0.342	0.136
Median	0.000	-0.143	0.000	-0.286	0.030	-0.671	0.204	-0.276	0.022
Max	4.014	2.571	3.273	11.350	10.229	5.245	4.029	5.199	5.342
Min	-4.951	-3.094	-1.237	-10.028	-7.779	-4.717	-3.147	-7.345	-6.956
S.D.	1.398	0.943	1.016	2.101	2.687	1.906	1.498	1.966	1.370
Skewness	0.182	0.135	0.953	0.882	0.704	0.614	0.393	-0.242	-0.225
Kurtosis	4.316	4.267	3.351	7.442	4.730	3.671	2.891	3.974	5.302
J.B	10	6	9	641	43	7	1	10	194
Prob.	0.005	0.039	0.011	0.000	0.000	0.029	0.500	0.007	0.000
Obs.	135	93	58	673	207	87	53	201	848

	Bear	Bull	Bear	Bull	Bear	Bull	Bear	Bull	Bear	Bull
Mean	-0.346	0.050	-0.331	0.152	-0.632	0.154	-0.180	0.096	-0.118	0.070
Median	-0.336	0.000	-0.190	0.124	-0.709	0.116	0.000	0.042	-0.099	0.041
Max	4.744	10.577	5.252	7.549	4.600	5.752	4.323	2.529	2.834	4.484
Min	-5.020	-16.063	-11.090	-5.443	-5.812	-3.361	-5.373	-2.436	-4.842	-3.196
S.D.	1.808	1.219	1.893	1.362	1.926	0.928	1.495	0.729	0.864	0.656
Skewness	0.020	-1.847	-1.356	0.157	-0.234	0.248	-0.130	0.069	-0.657	0.083
Kurtosis	3.499	42.797	10.374	6.150	4.055	6.747	4.447	4.507	7.121	9.172
J.B	1	59905	674	300	3	253	15	28	182	820
Prob.	0.625	0.000	0.000	0.000	0.279	0.000	0.001	0.000	0.000	0.000
Obs.	90	900	262	718	46	425	163	290	234	516

Table 11: The descriptive statistics of return series in Singapore

	Bull	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**
Mean	0.037	-0.168	0.340	-0.330	0.336	-0.215	0.314	-0.175
Median	0.000	-0.072	0.201	-0.182	0.235	-0.151	0.070	-0.192
Max	3.416	12.874	8.852	3.060	4.189	3.093	5.152	4.033
Min	-5.664	-9.153	-5.614	-8.549	-1.458	-5.790	-2.558	-3.088
S.D.	0.887	1.546	1.805	1.693	1.078	1.355	1.444	1.122
Skewness	-0.543	0.525	0.404	-1.133	0.742	-0.673	0.809	0.228
Kurtosis	9.266	16.870	4.972	7.289	4.341	5.143	4.148	3.825
J.B	482	5,425	65	104	10	76	21	9
Prob.	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.009
Obs.	286	673	346	106	60	283	127	254

	Bull	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**	**Bear**	**Bull**
Mean	0.099	-0.263	0.188	-0.115	0.073	-0.083	0.058	-0.167	0.058
Median	0.107	-0.166	0.133	0.000	0.057	-0.018	0.043	-0.102	0.000
Max	5.981	7.531	5.768	3.290	2.900	1.892	1.556	2.490	2.656
Min	-4.148	-8.696	-4.243	-3.769	-2.542	-2.538	-2.429	-4.390	-2.115
S.D.	0.974	2.001	1.233	1.013	0.766	0.693	0.523	0.901	0.690
Skewness	-0.221	-0.047	0.599	-0.599	0.009	-0.190	-0.407	-0.556	0.311
Kurtosis	6.027	5.343	6.133	5.016	4.332	3.844	4.640	5.731	4.485
J.B	467	84	204	54	31	7	43	73	55
Prob.	0.000	0.000	0.000	0.000	0.000	0.037	0.000	0.000	0.000
Obs.	1198	367	436	236	425	185	310	201	506

Consequently, shocks to the bear markets will heighten their volatilities to a larger extent, and if their volatilities spill over to the financial system, they will be more heavily affected. On the other hand, the clustering parameter (α) is high in bull phases for Malaysia and Singapore. The significance of cluster patterns for all markets is an indication that shocks to the markets do accelerate in subsequent periods, and if there is a common shock to all markets, the magnitude of the effect on the system will be substantial. This calls for close watching of the stock markets by regulators.

3.5.2 Asymmetry (the sign effect)

A contribution of this study is the identification of whether the stock market reactions to positive and negative shocks ($\gamma > 0$, $\gamma < 0$) are asymmetric and how these should be used to identify bull or bear markets. Our results indicate that for all periods, the signs for γ are negative and significant, confirming the prevalence of asymmetry in all cases. More specifically, negative shocks are found to increase the volatility of stock market returns more than the positive shocks, which is similar to what is observed in the literature.

The relative magnitude of a negative and a positive shock effect on volatility is measured by the relative intensity ratio $|-1 + \gamma| / (1 + \gamma)$. The values for intensity of asymmetry, reported in Tables 12-16, show the extent to which a negative innovation will differentially impact volatility compared to a positive innovation of the same magnitude. In most cases (except for two bull periods in the Philippines and Thailand), we obtain ratios that are higher than 1, indicating that a negative innovation, in most cases, will increase volatility more than a positive innovation, and the effects of negative innovations are much greater. Thailand exhibits the greatest asymmetry with a ratio of 6.194 in the bear market. The implication is that the former shock is of more concern to the investors and regulators during market fluctuations because its changes will be sharper and

its impact on the system will be stronger. Asymmetry is small to moderate for bull markets, as no extreme asymmetry is observed. The results are consistent with the work of Engle and Ng (1993) that the asymmetry (leverage) effect is prevalent in stock markets. However, Braun et al. (1995) reported that this effect occurred mainly at the market level while it was limited for industry portfolios. Another interesting point is that, as far as it applies to all markets, negative shocks do lead to greater volatility. This implies that during market downturns, stock markets need to be watched carefully or should be hedged in order to limit their risk and risk-elevating impact on the financial system.

3.5.3 Shock persistence

Firstly, we note that the GARCH effects are present and statistically significant in all markets, suggesting further evidence of persistence in stock market volatility. More particularly, the β estimates for the markets are positive and exhibit values greater than 0.90, suggesting that current volatility depends strongly on lagged volatility in each sub-period. For Indonesia, Malaysia, and Singapore, high values of β parameters indicate a significant degree of volatility persistence in both the bull and bear markets, reflecting the extent to which a momentum effect is presented in the conditional volatility process. This also indicates the presence of a clustering effect, whatever the conditions of the stock market are. It is worth noting that the persistence degree is higher during bull markets for the Philippines and Thailand.

Table 12: EGARCH estimation results: Indonesia

Market	Indonesia							
	ω	α	γ	β	Intensity of Asymmetry	ARCH (1) Test	ARCH (5) Test	ARCH (10) Test
Bull	-0.528***	0.476***	-0.105	0.580***	1.234	0.214	2.599	4.741
Bear	-0.048	0.231***	-0.208***	0.947***	1.525	0.224	0.979	1.678
Bull	0.164	0.917*	0.249	0.671***	0.602	0.614	1.791	5.077
Bear	-0.071	0.272***	-0.129***	0.839***	1.296	0.088	2.467	17.441
Bull	-0.123***	0.242***	-0.173***	0.839***	1.418	0.216	7.649	14.390
Bear	0.129**	-0.178**	-0.277***	0.983***	1.766	0.494	5.494	10.829
Bull	-0.140***	0.196***	-0.061***	0.977***	1.130	0.166	2.949	11.637
Bear	-0.153	0.412	-0.422**	0.821***	2.460	0.135	1.506	4.120
Bull	0.036***	-0.059***	-0.025	0.996***	1.051	0.228	8.453	16.588
Bear	0.159**	-0.213**	-0.167**	0.988***	1.401	0.834	3.906	4.810
Bull	-0.069***	0.082**	-0.028	0.989***	1.058	2.359	6.142	6.912

Notes: *** denotes significance at 1% level. ** denotes significance at 5% level. * denotes significance at 10% level.

Table 13: EGARCH estimation results: Malaysia

Market	Malaysia							
	ω	α	γ	β	Intensity of Asymmetry	ARCH (1) Test	ARCH (5) Test	ARCH (10) Test
Bull	-0.080***	0.101***	-0.047*	0.992***	1.099	1.938	3.212	6.055
Bear	-0.030	0.093*	-0.181***	0.984***	1.442	1.089	1.722	6.228
Bull	-0.103*	0.247***	-0.050	0.924***	1.105	0.608	2.320	6.983
Bear	-0.077	0.147*	-0.129***	0.943***	1.296	0.458	1.726	3.218
Bull	-0.326***	0.412***	-0.016	0.778***	1.033	0.682	11.303**	12.393
Bear	-0.017	-0.018	-0.249***	0.947***	1.663	0.287	3.930	12.876
Bull	-0.136***	0.167***	-0.020	0.980***	1.042	0.194	6.525	7.334
Bear	0.042	-0.050	-0.210***	0.931***	1.532	0.013	0.749	1.895
Bull	-0.106***	0.126***	-0.047***	0.989***	1.099	9.034***	11.012	14.939
Bear	0.052**	-0.073***	-0.112***	0.989***	1.252	0.005	7.791	13.700
Bull	-0.090***	0.091**	-0.044*	0.989***	1.092	0.126	2.515	6.639

Notes: **** denotes significance at 1% level. ** denotes significance at 5% level. * denotes significance at 10% level.*

Table 14: EGARCH estimation results: Philippines

Market	Philippines							
	ω	α	γ	β	Intensity of Asymmetry	ARCH (1) Test	ARCH (5) Test	ARCH (10) Test
Bull	-0.043*	0.052*	-0.058***	0.982***	1.123	2.871	8.655	20.638**
Bear	-0.109**	0.239***	-0.161***	0.970***	1.384	5.908**	6.873	9.189
Bull	0.111**	-0.128**	0.122***	0.977***	0.783	0.078	5.577	14.527
Bear	-0.097**	0.260***	-0.148***	0.876***	1.347	0.035	0.088	0.201
Bull	0.646	-0.257	0.003	-0.510	0.994	0.042	7.622	12.651
Bear	0.382	-0.548***	-0.054	-0.289	1.113	0.001	8.970	11.172
Bull	-0.161***	0.255***	-0.019	0.910***	1.040	1.885	3.673	6.820
Bear	-0.030	0.121	-0.203***	0.936***	1.509	1.163	6.852	13.017
Bull	-0.191***	0.252***	-0.075***	0.945***	1.162	0.132	0.977	8.599
Bear	0.357***	-0.355***	-0.323***	0.959***	1.954	1.469	5.537	14.174
Bull	0.064***	-0.114***	-0.077***	0.975***	1.167	2.777	8.728	13.394
Bear	0.176	0.066	-0.031	-0.868***	1.065	0.168	1.739	2.211
Bull	-0.151	0.163	-0.020	0.911***	1.040	3.035	6.834	10.749
Bear	0.149*	-0.172	-0.129	0.997***	1.296	0.071	1.139	6.187
Bull	-0.794	0.051	0.028	-0.293	0.946	2.974	9.848	10.524

Notes: *** denotes significance at 1% level. ** denotes significance at 5% level. * denotes significance at 10% level.

Table 15: EGARCH estimation results: Thailand

Market	Thailand							
	ω	α	γ	β	Intensity of Asymmetry	ARCH (1) Test	ARCH (5) Test	ARCH (10) Test
Bull	0.844	-0.124	-0.475**	0.033	2.810	0.816	1.056	3.664
Bear	0.182*	-0.220*	-0.170***	1.000***	1.410	0.187	3.781	8.914
Bull	-0.077	0.082	0.332	-0.604	0.501	0.002	3.343	9.507
Bear	-0.143***	0.260***	-0.071**	0.965***	1.153	4.830**	9.464	16.753
Bull	2.577***	0.202	0.272**	-0.332	0.572	0.072	3.302	3.485
Bear	0.326***	-0.304***	-0.032	0.958***	1.066	1.887	4.597	7.721
Bull	1.795***	-1.682***	-0.499**	0.161**	2.992	1.701	3.975	8.723
Bear	-0.054	0.244*	-0.148**	0.886***	1.347	1.423	9.972	12.444
Bull	-0.087***	0.177***	-0.001	0.917***	1.001	2.740	7.437	9.886
Bear	0.097	-0.143	-0.242*	1.036***	1.639	0.558	2.111	7.752
Bull	-0.094***	0.133***	-0.065**	0.924***	1.139	0.139	0.236	0.370
Bear	-0.004	0.082	-0.222***	0.929***	1.571	0.438	2.907	6.637
Bull	-0.108***	0.168***	-0.042	0.961***	1.087	0.342	4.344	16.001
Bear	0.717*	-0.492	-0.722**	0.676***	6.194	0.298	3.418	9.193
Bull	-0.165***	0.172***	-0.140***	0.940***	1.326	0.262	1.945	10.269
Bear	1.288***	-0.369	-0.175	-0.264	1.424	0.344	10.148	11.737
Bull	0.060***	-0.098***	-0.120***	0.992***	1.273	0.663	7.541	9.448
Bear	-0.294	-0.246	-0.294**	-0.511*	1.833	0.075	14.369**	17.536
Bull	0.118***	0.138***	-0.024	0.989***	1.049	0.775	2.235	7.196

Notes: *** denotes significance at 1% level. ** denotes significance at 5% level. * denotes significance at 10% level.

Table 16: EGARCH estimation results: Singapore

Market	Singapore							
	ω	α	γ	β	Intensity of Asymmetry	ARCH (1) Test	ARCH (5) Test	ARCH (10) Test
Bull	-0.093	0.102	-0.039	0.963***	1.081	1.302	3.836	4.534
Bear	-0.112***	0.156***	-0.131***	0.978***	1.301	0.738	6.646	8.646
Bull	-0.182***	0.307***	-0.087	0.935***	1.191	0.090	3.335	4.353
Bear	1.775***	0.087	0.096	-0.913***	0.825	0.102	1.608	2.722
Bull	0.256	-0.333	-0.084	0.963***	1.183	5.056**	9.347	10.822
Bear	-0.046	0.095	-0.160***	0.968***	1.381	0.106	5.846	6.896
Bull	0.188***	-0.245***	-0.039	0.966***	1.082	0.057	0.726	7.250
Bear	0.150***	-0.172***	-0.092**	0.956***	1.203	0.125	8.241	9.271
Bull	-0.136***	0.173***	-0.028	0.979***	1.058	0.834	4.872	15.319
Bear	0.110***	-0.100***	-0.184***	0.976***	1.451	0.344	4.978	7.303
Bull	-0.133***	0.165***	-0.043	0.991***	1.089	2.875	12.154**	19.935**
Bear	-0.067	0.089	-0.122**	0.978***	1.278	0.972	5.710	16.154
Bull	0.034***	-0.061***	-0.055***	0.994***	1.116	0.814	3.722	6.585
Bear	0.096***	-0.153***	-0.039*	0.982***	1.081	0.221	3.269	14.792
Bull	-0.526***	0.228*	-0.245***	0.742***	1.649	0.292	4.083	13.058
Bear	0.109***	-0.141***	-0.130***	0.975***	1.299	0.648	3.651	11.048
Bull	0.029***	-0.048***	-0.011	0.994***	1.022	0.412	4.254	10.441

Notes: *** denotes significance at 1% level. ** denotes significance at 5% level. * denotes significance at 10% level.

4. Conclusions

Unlike other studies which examine asymmetry and persistence of stock return volatility in relation to either economic activities or stock market conditions in a single market group (either a developed or emerging country), this paper combines the two types of market groups to look at the ASEAN-5, which includes both developed and emerging markets, using a rigorous econometric analysis. This study makes meaningful contributions to the academic debate in the extant literature and enriches our understanding of this topic.

The results of the study highlight that there is a prevalence of asymmetry in all cases. More specifically, negative shocks are found to increase the volatility of stock market returns more than positive shocks, which is similar to what is observed in the literature (Emenike, 2010; Farag, 2013). More specifically, Thailand exhibits the greatest asymmetry in bear markets. In general, asymmetry is small to moderate for bull markets, as no extreme asymmetry is observed. The results of asymmetry lend strong support to the topic of volatility modelling. Stock return volatility displays an apparent asymmetric response to shocks, which has a more pronounced and permanent effect during unstable periods than during stable periods. Such effects should be taken into account whenever volatility modelling of stock returns is considered, particularly during volatile periods. To increase forecasting performance, the models that allow for asymmetry and long memory in volatility are recommended.

Moreover, we noted that the GARCH effects are present and statistically significant, suggesting further evidence of persistence in stock market volatility. This also indicates a high presence of a clustering effect. For the Philippines and Thailand, stock return volatility is more persistent in bull markets than in bears, showing the β estimates for the bull markets are positive and exhibit values greater than 0.90. This suggests that current volatility depends strongly

on lagged volatility in an uptrend market. On the other hand, higher persistent volatility has been generally found in the bear markets compared to bulls for Indonesia, Malaysia, and Singapore. It is worth noting that the results in Indonesia, Malaysia, and Singapore are common regarding the negative asymmetry and high persistence in bear markets. However, investing in different countries should react differently to the same event. If investors perceive risk factors in their own country in a similar way to other countries, a diversification benefit will not be effective. From the view of investors, market integration can reduce the scope for diversification possibilities. Many studies agree that there has been an increase in correlations among the ASEAN5 stock markets, and these have accelerated since the Asian financial crisis (Ng, 2000; Yang et al., 2003; Yilmaz, 2010). At the same time, institutional investors must develop new strategies for portfolio management in order to manage better diversification benefits, which are continuously reduced for international stock markets. Inevitably, our results confirm a limitation in reducing portfolio risk across the region. Even though the benefits of international portfolio diversification across the ASEAN5 are reduced, they are not eliminated. Thailand and the Philippines show different results that the persistence degree is higher during bull markets than during bear markets. This suggests that the Filipino and Thai stock markets escape the financial downturn faster than the others. In order to improve stock market efficiency and better control their volatility persistence and risk management, regulations and changes based on the Philippines and Thailand's stock market frameworks could be a useful benchmark. Furthermore, this paper examines the characteristics of stock return volatility for the ASEAN5, including four emerging stock markets and one developed stock market. The data for the international market is necessary to be studied in order to attain diversification benefits. Therefore, institutional investors can develop new strategies for portfolio management with the intention of better diversification benefits.

The findings of the presence of asymmetry and persistence in volatility have important policy implications. With the presence of asymmetric volatility, policy-makers need to be more pro-active in establishing and stimulating their policies during periods of negative impacts. This is because, when negative shocks occur, investors would generally have a negative sentiment and then over-react to the shocks. This can make the stock market sinking even worse. When the volatility is high at certain times, it is very likely that this volatility will persist. Therefore, when negative shocks happen, both asymmetry and persistence in volatility would cause an additional effect. Asymmetry causes higher volatility which then, as a result of persistent volatility, would intensify the problem. On the other hand, during the time of positive impacts, investors over-react to their optimistic expectations, and stock markets may face a quick overheating problem. Consequently, appropriate counter-cyclical policy measures need to be established to respond to the adverse impact of negative shocks and to stabilise the stock market. The ability to identify turning points would provide policy-makers with additional information to discern the causes of return volatility and provide an advantage to them to stabilise the stock market.

References

Acemoglu, D., Scott, A., 1993. A theory of economic fluctuations; increasing returns and temporal agglomeration. CEP LSE Discussion Paper. No. 163.

Acemoglu, D., Scott, A., 1994. Asymmetries in the cyclical behaviour of UK labour markets. The Economic Journal, 104, 1303–1323.

Alberg, D., Shalit, H., Yosef, R., 2008. Estimating Stock Market Volatility Using Asymmetric GARCH Models. Applied Financial Economics, 1 (18), 1201.

Arshad, S., Rizvi, S.A.R., 2015. The troika of business cycle, efficiency and volatility: An East Asian perspective. Physica A, 419, 158–170.

Baillie, R.T., Bollerslev, T., 1989. Common stochastic trends in a system of exchange rates. Journal of Monetary Economics, 44, 167–181.

Beine, M., Laurent, S., Lecourt, C., 2002. Accounting for conditional leptokurtosis and closing days effects in FIGARCH models of daily exchange rates. Applied Financial Economics, 12, 589–601.

Bollerslev, T., 1987. A conditionally heteroskedastic time series model for speculative prices and rates of return. Review of Economics and Statistics, 69, 542–547.

Braun, P.A., Nelson, D.B., Sunier, A.M., 1995. Good News, Bad News, Volatility and Betas. The Journal of Finance, 50 (5), 1575-1603.

Cevik, E.I., Dibooglu, S., Kenc, T., 2016. Financial stress and economic activity in some emerging Asian economies. Research in International Business and Finance, 36, 127–139.

Chuang, W.I., Liu, H.H., Susmel, R., 2012. The bivariate GARCH approach to investigating the relation between stock returns, trading volume, and return volatility. Global Finance Journal, 23, 1–15.

Dickey, D., Fuller, W., 1979. Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association, 74 (366), 427–731.

Dukes, W.P., Bowlin, O.D., MacDonald, S.S., 1987. The performance of beta in forecasting portfolio returns in bill and bear markets using alternative market proxies. Quarterly Journal of Business & Economics, 26, 89–103.

Emenike, K.O., 2010. Modelling stock returns volatility in Nigeria using GARCH models. MPRA Research paper series No. 22723 [online]. Available from: (http://mpra.ub.uni-muenchen.de/22723). [Accessed 10.12.2018].

Engle, R.F., Ng, V.K., 1993. Measuring and testing the impact of news on volatility. The Journal of Finance, 48, 1749 – 1778.

Fakhfekh, M., Hachicha, N., Jawadi, F., Selmi, N., Cheffou, A.I., 2016. Measuring volatility persistence for conventional and Islamic banks: An FI-EGARCH approach. Emerging Markets Review, 27, 84–99.

Farag, H., 2013. Price limit bands, asymmetric volatility and stock market anomalies: Evidence from emerging markets. Global Finance Journal, 24, 85–97.

Gil-Alana, L.A., Shittu, O.I., Yaya, O.S., 2014. On the persistence and volatility in European, American and Asian stocks bull and bear markets. Journal of International Money and Finance, 40, 149–162.

Granger, C.W.J., Newbold, P., 1974. Spurious regressions in econometrics, Journal of Econometrics, 2, 111-120.

Hacker, R.S., Hatemi, J.A., 2009. MV-ARCH: GAUSS module to implement the multivariate ARCH test. Statistical Software Components. Nr. G00009, Boston College Department of Economics.

Harris, R., Sollis, R., 2003. Applied time series modelling and forecasting. United Kingdom: Wiley.

Holmes, M.J., Maghrebi, N., 2016. Financial market impact on the real economy: An assessment of asymmetries and volatility linkages between the stock market and unemployment rate. The Journal of Economic Asymmetries, 13, 1–7.

Horpestad, J.B., Lyócsa, S., Molnár, P., Olsen, T.B., 2019. Asymmetric volatility in equity markets around the world. North American Journal of Economics and Finance, 48, 540-554.

Jayasinghe, P., Tsui, A.K., Zhang, Z., 2014. Exchange Rate Exposure of Sectoral Returns and Volatilities: Further Evidence from Japanese Industrial Sectors. Pacific Economic Review, 19 (2), 216–236.

Jiranyakul, K., 2011. On the Risk-Return Tradeoff in the Stock Exchange of Thailand: New Evidence. Asian Social Science, 7 (7), 115-123.

Lunde, A., Timnermann, A., 2004. Duration dependence in stock prices. Journal of Business & Economic Statistics, 22 (3), 253–273.

Nelson, D., 1991. Conditional Heteroskedasticity in Asset Returns: A New Approach. Econometrica, 59, 347-370.

Ng, A., 2000. Volatility spillover effects from Japan and the US to the Pacific Basin. Journal of International Money and Finance, 19 (2), 207–233.

Pagan, A., Sossounov, K.A., 2003. A simple framework for analysing bull and bear markets. Journal of Applied Economics, 18, 23–46.

Todea, A., 2016. Cross-correlations between volatility, volatility persistence and stock market integration: the case of emergent stock markets. Chaos, Solitons and Fractals Nonlinear Science, and Nonequilibrium and Complex Phenomena, 87, 208–215.

Udoh, E.A.P., Udeaja, E.A., 2019. Asymmetric effects of financial dollarization on nominal exchange rate volatility in Nigeria. The Journal of Economic Asymmetries, 19, e00118.

Wiggins, J.B., 1992. Betas in up and down markets. Financial Revolution, 27, 107–123.

Yang, J., Kolari, J.W., Min, I., 2003. Stock market integration and financial crises: the case of Asia. Applied Financial Economics, 13 (7), 477–486.

Yilmaz, K., 2010. Return and volatility spillovers among the East Asian equity markets. The Journal of Asian Economics, 21 (3), 304–313.

Zare, R., Azali, M., Habibullah, M.S., 2013. Monetary Policy and Stock Market Volatility in the ASEAN5: Asymmetries over Bull and Bear Markets. Procedia Economics and Finance, 7, 18–27.