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VOLATILITY COMPONENT OF DERIVATIVE MARKET: EVIDENCE FROM FBMKLCI BASED ON CGARCH

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Abstract

This study examines the volatility component of Malaysian stock index. Despite extensive studies on stock index volatility, there are relatively few studies examining the volatility component of stock index in Malaysia. Using data from January 1, 2009 to December 31, 2013, this study aims to examine the volatility component of Malaysian stock index post financial crisis period, specifically on the mean-reversion, short-run (transitory) volatility, long-run (permanent) and speed of adjustment based on the generalized autoregressive conditional heteroskedasticity (GARCH). The finding reveals that both the KLCI and KLCI-Futures have persistence permanent volatility component, but transitory volatility components, on the other hand varies between the two markets. This study later confirms a faster mean-reversion in the KLCI-Futures comparative to KLCI. Nevertheless, the KLCI mean return remains positive during post crisis periods comparative to the futures market.

Keywords: *Transitory volatility, Permanent volatility, mean-reversion, speed of adjustment, stock index*

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Introduction

The uncertainty on investment returns due to market risk remains a serious concern in the financial studies as it impacts asset expected return over time (Sousa & Serra, 2008). Meanwhile, derivative instrument such as stock index futures is an innovative instrument that performs series of economic functions like pricing discovery function, liquidity function and risk management (Debasish, 2009; Mahalik *et al.*, 2014). Among all, risk management is the most attractive function of derivatives to investors (Bekkerman, 2011). It has been documented that the introduction of derivatives instrument has become a common practice in many emerging and transition economies.

Even with the economic functionality of derivatives instrument, policymakers and market regulators are still concern on the impact of stock index futures on the spot market (Debasish, 2009) which may be due to 1997 Asian financial crisis, 2008 global financial crisis and some other financial crises around the globe. Financial crisis is highly expensive to control especially if bail-out is required hence, some researchers begin to explore on the relationship between financial crisis and stock index volatility. This may be one of the reasons why researchers are interested in understanding the properties of dynamic volatility (Sousa &

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Serra, 2008) like the asymmetric impact of the news in the market (Xu et al., 2013), volatility spillover (Shamiri & Isa, 2010; Kumar, 2013; Kang & Yoon, 2014), volatility persistence and clustering (Michelfelder & Pandya, 2005; Pati & Rajib, 2010; Singhania & Anchalia, 2013) and volatility component. However, studies on volatility component in emerging market like Malaysia is relatively very few.

Obviously, good understanding on the volatility component provides a better understanding of mean-reversion, short-run (transitory) volatility and long-run (permanent) volatility. In practical sense, understanding market volatility component such as speed of adjustment (mean reversion) in case of any shocks in the market requires different attention from portfolio managers, policy makers and other market participants. Different speeds of adjustment require different attention. Therefore, the objective of this study is to examine the volatility component of derivative market in Malaysia and contributes to the body of knowledge by enhancing the understanding on the volatility of local derivative market in the context of mean reversion (speed of adjustment), short-run volatility and long-run volatility and fills the gap in the literature.

The rest of this paper is structured as follows: section 2 highlights previous literature. Section 3 provides a brief explanation on methodology, section 4 discusses the results and findings and finally section 5 concludes the study.

Previous Literature

Previous empirical studies on the properties of the dynamic volatility were mainly exploring on derivative instruments. Michelfelder & Pandya (2005) compared the stock index futures return volatility between the developed and emerging markets based on EGARCH. The study recorded low volatility of stock index futures return for developed markets but high volatility for emerging markets.

Pati & Rajib (2010) found evidence of asymmetric effect, volatility clustering and volatility persistence on the Indian stock index futures based on EGARCH models with generalized error distribution to capture the nonparametric nature of financial series. Shamiri & Isa (2010) examined the volatility driving forces of Asia-Pacific stock indices and the impact of shock from the developed market like the U.S and Japan on Asia-Pacific markets. They applied Bivariate Baba, Engle, Kraft, & Kroner-Generalized autoregressive Conditional Heteroskedastic (BEKK-GARCH) model with Student- *t* density. Their result showed stronger spillover effect of shock from the U.S. market to the Asia-Pacific market but not from Japan. They confirmed overlapping trading hour between Japan and Asia but, not the US. They argued that news impacts of the two developed countries are different. They concluded that their result may justify the capital flow from the U.S to Asia-Pacific rather than Japan.

Singhania & Anchalia (2013) explored the impact of the global financial crisis on Asian stock index futures return (Hong Kong, Japan, China, and India) using EGARCH model. The study confirmed high persistence volatility, volatility clustering and asymmetric effects. The result revealed that China stock index futures return is positively affected by the sub-prime crisis but negatively affected by the Eurozone debt crisis. Japan stock index futures return is positively affected by the sub-prime crisis while Indian stock index futures return is negatively affected by the Eurozone debt crisis.

Kang & Yoon (2014) studied the volatility spillover of the Japanese and Korean stock index futures by using the high-frequency prices series of three-time intervals, 10 minutes, 30 minutes and 1 hour, and capture the short-term volatility in the markets based on multivariate GARCH-type (BEKK GARCH). Their findings indicated that the spillover effect differ from one time interval to another. Their findings established a bi-directional relationship with 10 minutes time interval while becoming weaker as time increases. The unidirectional relationship is evidenced from Japan stock market to Korean stock market based on 30 minutes and 1 hour intraday price volatility. This indicates that different time interval exhibits different volatility information. The finding is consistent with Kumar (2013) on bi-directional volatility spillover.

Research Methodology

This study uses daily price series downloaded from Bloomberg for KLCI Index (spot) and KLCI index futures (KLCI-F) for the period ranging from January 1, 2009 to December 31, 2013. Price series were converted to returns in logarithm form to eliminate the effect of outliers on the series (Shamiri & Isa, 2009; Pati & Rajib, 2010). Besides, volatility is an unobservable process hence, return series is used as a proxy for measuring market volatility (Pati & Rajib, 2010; Kumar, 2013). Return is expressed as following:

$$R_t = 100*\log (P_t/P_{t(-1)}) \quad \ldots\ldots(1)$$

where R_t stands for the return of the KLCI (spot) or KLCI index futures at the time, *t*. P_t stands for the price of the KLCI (spot) or KLCI index futures at the time, *t*. $P_{t(-1)}$ stands for the previous price of KLCI (spot) or KLCI index futures, at the time, *t-1*. At the same time, to capture the days required by the shock in market to decay to the half of the original value we applied half-life of decay which is expressed as following:

$$\text{Half-life of decay} = \frac{\log o.5}{\log \emptyset} \quad \ldots\ldots(2)$$

where, log $\emptyset$ is the coefficient of the volatility of the market being it permanent or transitory.

We first examine the properties of data series based on descriptive statistics and then perform preliminary tests like unit root test and ARCH effect test on the return series. It is worth noted that modeling market volatility is subject to the rejection of the null hypothesis of ARCH effect. Furthermore, the distribution of the data for the analysis is based on post- Asian and post-global financial crisis. Descriptive statistic provides some hint on the volatility of the series through mean, standard deviation, skewness and kurtosis. Unit root test is conducted using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test. The returns series are stationary at first difference, I∼(1). ARCH effect test rejects the null hypothesis of no ARCH effect (descriptive report is not provided here due to limited space).

We then proceed with the modeling of component of the market using component generalized autoregressive conditional heteroskedastic (CGARCH) model. The modeling approach provides a more extensive information on market volatility by splitting the component of the market volatility into permanent volatility (γ_4) and transitory volatility ($\gamma_6 + \gamma_7$) and provide information on the speed of adjustment.

Empirical Result of CGARCH Model

Table 1: CGARCH result of KLCI and KLCI-F for post-Asian Financial Crisis

		Mean Equation	
		FBMKLCI	FBMKLCI Index Futures
		0.5228*	-0.0249 (0.2941)
		Variance Equation	
		FBMKLCI	FBMKLCI Index Futures
	γ_4	0.9968*	0.9976*
	$\gamma_6 + \gamma_7$	0.7266*	0.9128*
ARCH Test		0.4655 (0.4951)	0.4477 (0.5035)

Post Asian financial crisis, Table 1 shows that the average return of KLCI is positive and statistically significant (p=0.01), but the mean return of KLCI-F remains negative but statistically insignificant. The study shows that permanent volatility is persistent. The transitory volatility is slower in KLCI than in KLCI-F. This indicates that despite the negative mean return of KLCI-F, the speed of adjustment to the equilibrium in the long-run is faster than the spot market.

Table 2: CGARCH result of KLCI and KLCI-F for post-global financial crisis

		Mean Equation	
		FBMKLCI	FBMKLCI Index Futures
		0.0885*	-0.0742*
		Variance Equation	
		FBMKLCI	FBMKLCI Index Futures
	γ_4	0.9914*	0.9966*
	$\gamma_6 + \gamma_7$	0.8281*	0.9231*
ARCH Test		0.0045 (0.9467)	0.0069 (0.9310)

For post global financial crisis, the mean return on KLCI remains positive and statistically significant while the mean return of KLCI-F remains negative and statistically significant (p=0.01). Permanent volatility is persistence for both markets. Mean-reversion is slower in spot market than in futures. This finding is consistent with Michelfelder & Pandya (2005) on negative mean return and high volatility persistence of KLCI-F. Policymakers are advised to be alert at any activities that may increase speculative activities in the market. Although speculative trading may increase market liquidity, investors' interests should not be jeopardized. Finally, we proceed with quantifying days required by each estimate and the result of the finding is provided in Table 3.

Table 3: Report on days required for shock to decay to half of the original value

Phases of Analysis	Short-run		Long-run	
	KLCI Spot	KLCI Futures Index	KLCI Spot	KLCI Futures Index
Asian Crisis	2 days and 2hours	7 days and 7 hours	215 days	301days
Global Crisis	3days and 8 hours	8 days and 8 hours	79days and 2hours	200 days and 8 hours

Table 3 shows variations on the days required for the shock to decay to the half of the original shock after the market has experienced financial crisis. Longer days are required for shock to decay to half of the original shock after the Asian financial crisis but relatively lower after the global financial crisis as shown in the phases of the analysis. This implies that

financial crisis has significant impact on the KLCI-F. We carry out the diagnostic test for each analysis and the result indicates that the heteroskedasticity test is statistically insignificant. This confirms that the study does not violate the diagnostic test.

Conclusion

This study explores the volatility component of Malaysia financial derivative market focusing on stock index. In this study we grouped the return series into different categories following 1997 Asian financial crisis and 2008 global financial crisis. These two events may result in structural break in the returns data set. This study shows that the mean return is positive after the Asian crisis and global financial crisis for KLCI but remains negative for the KLCI-F throughout the period examined. Volatility in KLCI and KLCI-F is highly persistence in the long-run while the mean-reversion is different for KLCI and KLCI-F. The speed of adjustment is slower in KLCI than in KLCI-F. Half-life of decay of the market shock is substantially longer for both the KLCI and KLCI-F in the long-run than in the short-run. We advise market regulators and policymakers to be alert on any activities that may contribute to continuous negative mean returns on the KLCI-F.

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