Advanced Science Letters
Vol. 23, No.8, August 2017, pp.7215-7217
DOI:https://doi.org/10.1166/asl.2017.9333

Prediction Volatility of JKSE in Indonesia Stock Exchange

Nuryasman MN
Faculty of Economic, Tarumanagara University, 11470, Indonesia

This paper attempts to examine the impact of changes in the SBI rate, inflation and the rupiah per US Dollar (USD) against the volatility of the JKSE to be used as a guide by both policy makers and market participants in the capital market. Prediction of the JKSE volatility would be predicted by using the GARCH and EGARCH approach. The results of data processing during the period January 1998 to December 2015, found a significant effect between the SBI rate, inflation and the rupiah per US dollar against volatility of the JKSE in IDX at 99% confidence level. Model AR (5)-EGARCH (1,5) was the best model for predicting stock index volatility than other models on the Stock Exchange.
Keywords: **JKSE, GARCH, and EGARCH.**

1. INTRODUCTION

According to Co-integration and Causality Bapepam-LK team study, Indonesian stock market is a part of emerging market with high capitalization and a lower liquidity rate than American and Europe stock market. This condition makes the stock market volatility become very high and interested for local and foreign investors to invest in Indonesia.

Stock market fluctuation tends to create uncertainty to get future yield which reflected from the risk faced by the investors.

JKSE development has experienced the sharpest contraction which caused by the Asia currency crisis where Indonesian experienced the impact with Rupiah depreciation against US Dollar from Rp9,780.153 in January 1998 to Rp14,243.871 in July 1998. Along with the Rupiah depreciation against US Dollar, JKSE depressed around 42.67% from 481.72 in July 1998 to 276.15 in September 1998. Indonesian stock market condition until the mid of 2003 fluctuated with not too high volatility and showed the significant development (Bullish) after May 2003 but depressed again which caused by Subprime Mortgage in 2008 and Greece Loan crisis in 2010 even though not as bad as the condition in 2008.

The pressure against Indonesian stock market showed by the depreciation of JKSE also repeated in May 2013 until the end of December 2013 which caused by political constellation in Indonesian election, so it showed the negative sentiment against stock market performance.

This high stock price volatility will be attracted by investors, the stock with high risk will be attracted by Risk Seeker/Lover category investors, although Risk Averse category investors tend to buy the stock which give the normal profit. The development of stock market has to be given attention for getting information, so the risk can be minimized and the investors profit can be maximized.

This research is trying to formulate a problem, is the JKSE volatility in Indonesian stock exchange affected by volatility and previous JKSE variants?

2. LITERATURE REVIEW

Inflation is the increasing price in general and continually in economy. In a long term, inflation is monetary phenomenon caused by the faster growth amount of money than GDP potential, although in a short term, the causes of inflation is triggered by price changes and real GDP.

Inflation will drive the rise of goods so it will reduce the people buying power. This condition will lessen the investor interest to do investment, so it causes the decrease of stock price index in stock market.

The effect of inflation to stock price index have been researched by Hsing (2011), Dasgupta (2012), and Sirucek (2012) with the result of negative relationship between inflation with stock price index.

Reily and Brown (2003) interest rate is the remuneration from the money borrowed from a banking institution.

Based on BI circular letter no 8/13/DPM SBI is securities in the form of Rupiah which is issued by BI as an acknowledgement of loan in a short period. One of the goal to publish and sold SBI by BI is to keep the stability of Rupiah and reduce the excess of primary money (currency and demand deposit in BI).
SBI transaction is done by BI with increasing or decreasing remuneration from SBI in the form of SBI interest.

The increasing interest rate from SBI is followed by the increasing of deposit interest rate. The effect of SBI increasing interest rate tends to reduce the stock price in stock market.

The research from Gan, et al (2006), and Dasgupta

*nuryasman@fe.untar.ac.id

 1936-6612/2012/4/3398/005 doi:10.1166/asl.2017.9333

(2012) found the positive relationship between the interest rate with the stock price, this finding is similar with Wongbangpo and Sharma (2002) for the case in Indonesia Malaysia. While the finding by Tripathy (2011), Hooker (2004), Kandir (2008), and Herve, et al (2011) found the negative relationship between the interest rate with the stock price index, this finding is similar with the researched by Wongbangpo and Sharma (2002) for the case in Philippine, Singapore and Thailand.

Exchange rate is the price of a nation currency in the form of currency unit or commodity (usually gold or silver) from another country. While Parkin (2014) exchange rate is the price from the exchange of currency in a nation with the currency of another nation in foreign exchange market.

The stock price index in capital market is determined by exchange rate, if the ownership of stock in an exchange is more dominated by foreign investor, so the foreign currency appreciation will increase the index stock price in exchange, vice versa.

Some researches which review the relationship between exchange rate with price stock index like, Priyono, et al (2014), and Wongbangpo & Sharma (2012) for the case in Singapore and Thailand found the negative relationship, while the research by Kandir (2008), Gan et al (2006), Dasgupta (2012) and Jeong & Kim (2011) found the positive relationship. This finding is supported by Wongbangpo and Sharma (2002) for the case in Indonesia, Malaysia and Philippine.

3. POPULATION, SAMPLE AND DATA

This research is using all the listed stock price population in Indonesian Stock Exchange which reflected by JKSE in term of January 1998 – December 2015 with observation time for 216 months.

The variable which is used in this research, JKSE is the movement of all listed stock price in Indonesian Stock Exchange which measure by closing price. JKSE data is taken from www.yahoofinance.com/ publication.

ANALYSIS METHOD

This research compares the GARCH and EGARCH model to answer the research's problem.

The development in econometric found out that one of the approach to answer the problem from OLS like GARCH which is the development from the ARCH approach developed by Robert Engel (1982) and continued by Mill (1999). GARCH is developed by Tim Bollerslev in 1986 and enhanced in 1994.

GARCH model which is used in this research like the following equation (Wang, 2003):

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{n} \alpha_i X(i) + \sum_{j=1}^{m} \beta_j Z(j) \quad (1)$$

Where;

X(i) is *ARCH Effect* $\left(\left|\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right|\right)$, Z(i) is *GARCH Effect* $\left(\ln\left(\sigma_{t-j}^2\right)\right)$, α_i is coefficient *ARCH Effect*, and β_j is coefficient *GARCH Effect*.

Piot-Lepetit (2011), the coefficient number $(\alpha_i + \beta_j)$ showed volatility rate from model. f $(\alpha_i + \beta_j) > 1$ showed there is Explosive (Extreme) Volatility, $(\alpha_i + \beta_j) <$ means there is Low Volatility and $(\alpha_i + \beta_j) = 1$ means High Volatility.

Anders (2004), GARCH model cannot handle the asymmetric effect in data that has cross correlation between quadrat residual with lag, so it needs EGARCH (Exponential Generalized Autoregressive Conditional Heteroscedasticity) model which developed by Daniel B. Nelson (1991).

EGARCH model which is used in this research like the following equation (Wang, 2003):

$$\ln(\sigma_t^2) = \alpha_0 + \sum_{i=1}^{n} \alpha_i X(i) + \sum_{j=1}^{m} \beta_j Z(j) + \sum_{h=1}^{k} \gamma_h A(h) \quad (2)$$

Where;

X(i) is *ARCH Effect* $\left(\left|\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right|\right)$, Z(i) is *GARCH Effect* $\left(\ln\left(\sigma_{t-j}^2\right)\right)$, A(h) is *Asymmetric Effect* $\left(\frac{\varepsilon_{t-h}}{\sigma_{t-h}}\right)$, α_i is coefficient *ARCH Effect*, β_j is coefficient *GARCH Effect*, γ_h is coefficient *Asymmetric Effect*.

4. DISCUSSION

This research present with a hypothesis,

H1. JKSE volatility is influenced by volatility and variance from previous period.

Based from four criteria research variable processing, three criteria that are FPE, AIC and HQIC indicated lag which can be used in model are 5. After knowing the lag model, it can conclude the best model with AR (5) which will use for the two models of GARCH and EGARCH.

GARCH Model

GARCH Model used in this research is AR (5)-GARCH (1,5) after it has done some tests and iteration as shown in following table 1,

Table 1. Estimation Result AR (5)-GARCH (1,5)

Variables	Coefficient	Standard Error	$Z_{Statistic}$	Probability
α_1 :ARCH(1)	0.136	0.035	3.862	0.000
β_1 :GARCH(1)	-0.736	0.189	-3.883	0.000
β_2 :GARCH(2)	-0.872	0.067	-12.951	0.000
β_3 :GARCH(3)	-0.574	0.212	-2.708	0.007
β_4 :GARCH(4)	-0.787	0.107	-7.340	0.000
β_5 :GARCH(5)	-0.718	0.203	-3.540	0.000

The information from table 2 shown that JKSE volatility significantly determined by volatility and previous variance period at 1% level of confidence. Then the amount of ARCH Coefficient with GARCH (1) until GARCH (5) Coefficient result the JKSE volatility is smaller than 1 (-3.551) which means Low Volatility (Piot-Lepetit, 2011). The meaning is JKSE volatility in Indonesian Stock Exchange has little movement caused by JKSE movement in the previous period and some economy factors, such as SBI interest rate, inflation and exchange rate.

GARCH model (table 1) generally has shown the good result in statistic. This condition shows by significantly all ARCH and GARCH variables at 1% significant level, but to confirm that this model has fulfilled the criteria in doing prediction, it needs the test for heteroscedasticity, autocorrelation and asymmetric effect.

Heteroscedasticity GARCH model test is done with ARCH LM test as shown in table 2,

Table 2. ARCH-LM Test Model AR (5)-GARCH (1,5)

F-Statistic	0.04217	Prob. F(1,192)	0.83750
Observation*R^2	0.04260	Prob. Chi-Square (1)	0.83650

Probability Chi-Square score is bigger than 5% that shown in AR (5)-GARCH (1,5) model, heteroscedasticity didn't find or in the other word, model residual shown the constant variant (homoscedasticity).

Autocorrelation test is done with Correlogram-Q Statistic, if the Q Statistic probability is smaller than 5%, it means residual model has autocorrelation problem or vice versa.

AR (5)-GARCH (1,5) model until 36 lag Q Statistic probability still smaller than 5%, so there's a possibility that this model has problem with autocorrelation and asymmetric effect. So this model became not efficient, so it needs improvement with EGARCH model.

EGARCH Model

The result of estimation parameter model used AR (5)-GARCH (1,5) still found autocorrelation problem and asymmetric effect, so it used AR (5)-EGARCH (1,5) to get the best and efficient model to do the parameter valuation prediction which able handle the asymmetric effect.

Table 3. Estimation Result AR (5)-EGARCH (1,5)

Variables	Coefficient	Standard Error	$Z_{Statistic}$	Probability
α_1 :ARCH(1)	0.347	0.125	2.787	0.005
γ_1	0.258	0.088	2.922	0.004
β_1 :GARCH(1)	0.414	0.080	5.197	0.000
β_2 :GARCH(2)	0.133	0.101	1.309	0.191
β_3 :GARCH(3)	-0.252	0.092	-2.748	0.006
β_4 :GARCH(4)	-0.151	0.103	-1.471	0.141
β_5 :GARCH(5)	0.859	0.083	10.334	0.000

Based on the date processing result, it found the coefficient which can measure asymmetric effect (γ) as big as 0,258 bigger than zero that indicated asymmetric effect is not occurred against JKSE volatility (Buguk, et al:2003) so the EGARCH model can dismiss asymmetric affect that occurred from GARCH model. This asymmetric effect also can be detected if there is positive shock of Good News which shown from $\gamma_1 + \alpha_1 = 0.258 + 0.347 = 0.605$ bigger than negative shock of Bad News as seen from $\gamma_1 - \alpha_1 = 0{,}258 - 0{,}347 = -0.089$. This condition will increase JKSE volatility caused by there is good news than bad news, so in this model there is not asymmetric effect.

The Heteroscedasticity case test from AR (5)-EGARCH (1,5) model which used ARCH LM Test resulted that this model is free from inconsistent residual variable (heteroscedasticity) because Chi-Square probability is bigger than zero as shown in table 4 as follows,

Table 4. ARCH-LM Test Model AR (5)-EGARCH (1,5)

F-Statistic	0.257	Prob. F(1,192)	0.613
Observation* R^2	0.260	Prob.Chi-Square (1)	0.611

Beside heteroscedasticity case test, the test whether there is or not autocorrelation through Q-Statistic probability in Q-Statistic Correlogram found the probability which is bigger than 5% since 0-36 lag, which means AR (5)-EGARCH (1,5) has been free from autocorrelation problem.

GARCH and EGARCH Model Comparison

Based on the tested two models, all show that JKSE volatility is very affected by volatility and previous variance, but AR (5)-EGARCH (1,5) model is more efficient than AR (5)-GARCH (1,5) model to do prediction because it has MSE, MAE, and MAPE score lower with each 1.193,58800; 1.068,53900 and 92,97807. From variance and covariance proportion, AR (5)-EGARCH (1,5) model has the lower score than GARCH (1,5).

Beside prediction criteria, this model has been free from autocorrelation and inconsistent variance, which can be seen from Q-statistic and χ^2 probability is bigger than 5%.

The result from the two models shown completely in the following table 5

Table 5. JKSE Volatility Model Comparison

Criterion	AR(5)-GARCH(1,5)	AR(5)-EGARCH(1,5)
Prob. χ^2 (ARCH Effect)	0.837	0.611
Q-Stat (Autocorrelation)	0.000	0.853
Log Likelihood	-1374.758	-1136.865
MSE	1256.669	1193.588
MAE	1103.442	1068.539
MAPE	131.469	92.978
Bias Proportion	0.043	0.801
Variance Proportion	0.464	0.085
Covariance Proportion	0.493	0.114

5. CONCLUSIONS

The conclusion from this research found the JKSE volatility in Indonesian stock exchange with the best prediction uses AR (5)-EGARCH (1,5).

REFERENCES

1. Buguk, C. et al. Price Volatility Spillover in a Agricultural Markets: An Examination of US Catfich Markets, *Journal of Agricultural and Resource Economics*, Vol.28, No.1, (2003) 86-99.
2. Dasgupta, R, Long-Run and Short-Run Relationship between BSESENSEX and Macroeconomic Variables, *International Research Journal of Finance and Economcs*, Issue 95, (2012).
3. Enders, W. Applied Econometric Time Series, Second Edition, John Wiley and Sons, Inc. New York, (2004).
4. Gan, C.Lee, M., Yong, H.H and Zhang, J, Macroeconomic Variables and Stock Market

Interactions:New Zealand Evidence, *Investment Management and Financial Innovation*, Vol.3.Issue 4, (2006) 89-101.
5. Herve, Drama, B.G., Chanmalai, B. and Shen, Yao. The Study of Causal Relationship between Stock Market Indices and Macroeconomic Variables in Cote d"Ivoire: Evidence from Error-Correction Models and Granger Causality Test, *International Journal of Business and Management*, Vol.6, No.12, (2011).
6. Hooker, Mark A. Macroeconomic Factors and Emerging Market Equity Returns: A Bayesian Model Selection Approach, *Emerging Market Review*, 5, (2004) 379-387.
7. Hsing, Y. The Stock Market and Macroeconomics Variables in a BRICS Country and Policy Implications, *International Journal of Economics and Financial Issues*, Vol.1, No.1, (2011) 12-18.
8. Jeong, H.W., and Kim, J.W. The Impact of Main Macroeconomic Variables on VKOSPI Index *Department of Economics Pusan National University*, Busan, (2011).
9. Kandir, Serkan Yilmaz. Macroeconomic Variables, Firm Characteristics and Stock Returns: Evidence from Turkey, *International Research Journal of Finance and Economics*, Issue 16, (2008).
10. Parkin, Michael. Economics, 11th Edition, Global Edition, Pearson, (2014).
11. Piot-Lepetit, I. (2011). Price Volatility and Price Leadership in the EU Beef and Pork Meat Market, *Springer Science and Business Media*, (2011) 85-105.
12. Priyono, Anhar Fauzan., dan Bustaman, Arief. Volatility Transmission between Exchange Rates and Stock Prices in Indonesia post 1997 Asia Crisis, *Working Paper in Economics and Development Studies, No. 201404*, Department of Economics Padjadjaran University, (2014).
13. Reilly, Frank, K., and Brown, K.C. Investment Analysis and Portfolio Management, 7th, Edition, Florida, The Dryden Press, (2003.
14. Sirucek, Martin. Macroeconomic Variabels and Stock Market: US Review. *International Journal of Computer Science and Management Studies*, (2012 2231-5268.
15. Tripathy, N. Causal Relationship between Macroeconomic Indicators and Stock Market in India, *Asian Journal of Finance and Accounting*, Vol.3, No.1(2011).
16. Wang, P. Financial Econometrics Methods and Models, Routledge, New York, (2003).
17. Wongbangpo, Praphan and Subhash C. Sharma. Stock Market and Macroeconomic Fundamental Dynamic Interaction: ASEAN-5 Countries, *Journal of Asian Economics*, Vol.12, (2002) 27-51.