Financial Sector Stock Market: Return and Risk Analysis

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Abstract: *Financial sector stock market is a reflection of financial issuers incorporated in financial sector. Stocks of the financial sector havea good potential in generating returns. The purpose of this study is to analyze the factors influencing the return and risk of financial sector stockmarket. After testing several models, EGARCH (2,3) is selected as the best model to modelize return and volatility risk. Among six variables measured in mean equation, only European crisis that has an insignificant effect on the return of financial sector stock market, while other five variables have a significant effect. Subprime mortgage crisis, return of BI Rate, return of Customer Price Index (CPI), and return of Jakarta Composite Index (JCI) have a positive effect, while return of exchange rate IDR/US$ has a negative effect. Six variables are used to define the volatility risk. All variables have a significant effect at the critical value of 5%. There is an asymmetric volatility in financial sector stock market with positive sentiment (good news) generate greater effect than negative sentiments (bad news).*

Keywords: ARCH/GARCH/EGACH, banking stock, stock return, volatility risk

1. Introduction

Financial sector stock market is a reflection of financial issuers incorporated in financial sector. Financial stock is an interesting sector, especially considering the high level of market capitalization of many financial stocks and the issuers within it. In addition, financial institutions are predicted togain an increasing profitability. Financial institutions have the ability to improve thecommunity's economy (Hameedu 2014). The more Indonesian people utilizing the financial institutions, the more profits that the financial institutioin could obtain. The increasing profit will boost the stock returns of companies within financial sector. This opportunity should be harnessed by investors. But before investing in the financial stock market, investors should know what risks they face, especially risks that come from external sources and volatility risk. Therefore, this study aims to analyze the variables affecting the return and volatility risk in the financial sector stock market.

2. Data

The data used in this study are secondary data, in the form of monthly data from December 2005 until December 2015. Secondary data used in this research is the data of financial sector stock market in Indonesia (reflected by financial sector stock index) as a dependent variable. The other four variables is used as an independent variables, namely the exchange rate of Indonesian Rupiah (IDR) against US$ (IDR/US$), BIRate, the Consumer Price Index (CPI), and the Jakarta Composite Index (JCI). Besides, this research uses *dummy* variables of European crisis and Subprime Mortgage crisis. Subprime Mortgage crisis started since September 2008 until April 2009 (SETNEG 2009), while European crisis occured from July 2011 until November 2011 (Bappenas 2011).

3. Methodology

The three stages of this study are as follows: 1) Pre-estimation test; 2) Model estimation and selection of the best

model; 3) Model evaluation. The first stage consists of four initial tests, namely stationarity test, multicollinearity test, autocorrelation test, and heteroscedasticity test using the ARCH effect test. The main stage in this study is estimating the model (the second stage), which will be explained profoundly. Model evaluation stage comprises correlogram Q-stat, correlogram squared residuals, normality test, and ARCH LM test.

Two methods used in the model estimation stage are ordinary least squares and variations of ARCH/GARCH using a combination of order-0 to order-3. The combination used are ARCH (1,0), GARCH (0,1), GARCH (1,1), ARCH (2,0), GARCH (2,0), GARCH (2,1), GARCH (1,2), GARCH (2,2), GARCH (3,0), GARCH (0,3), GARCH (3,1), GARCH (1,3), GARCH (3,2), GARCH (2,3), and GARCH (3,3). Among those models, the best model is selected using the Akaike Information Criterion (AIC), Schwartz Information Criterion (SC) and Hannan-Quinn Criterion (HQ). The best model is the one which has the lowest value of AIC, SC, and HQ. After obtaining the best model based on those variations, the best model is tested with the Threshold GARCH model and Exponential GARCH (TGARCH and EGARCH) to find out whether the asymmetric volatility exists in financial sector stock market.

The equation below is a mean equation used to modelize the return and variance equation used to modelize the volatility risk. The estimation method of ordinary least squares only uses mean equation, whereas the ARCH/ARCH variation method modelize mean and variance equation simultaneously (Bollerslev 1986).

$$r_t = a_t + b_{EC}EC_t + b_{SMC}SMC_t + b_{BIRATE}BIRATE_t + b_{ER}ER_t + b_{IHK}IHK_t + b_{IHSG}IHSG_t$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i e_{t-i}^2 + \sum_{i=1}^{p} \beta_i \sigma_{-1}^2$$

The eight hypotheses used in this study are as follows：
H1   The European crisis negatively affects the return of financial sector stock index ($b_1 < 0$)． It is supported

by the research of Singhania and Anchalia (2014) and Luo (2014).

H2 The Subprime Mortgage crisis negatively affects the return of financial sector stock index ($b_2 < 0$). It is supported by the researchof Singhania and Anchalia (2014) , also Luo (2014).

H3 BI-Rate negatively affects the return of financial sector stock index($b_3 < 0$). It is supported by the researchof Herve$et\ al$. (2011) , also Kuwonru and Owusu (2011).

H4 Exchange rate IDR/US\$ negatively affects the return of financial sector stock index ($b_4 < 0$). It is supported by the research ofKuwornu$et\ al$. (2011) and Muzindutsi and Niyimbanira (2012).

H5 Customer Price Index (CPI) negatively affects the return of financial sector stock index ($b_5 < 0$). It is supported by the research of Benakovic and Posedel (2010).

H6 Jakarta Composite Index (JCI or IHSG)positively affects the return of financial sector stock index ($b_6 > 0$). It is supported by the research of Butt $et\ al$. (2010)and Muzindutsi and Niyimbanira (2012).

H7 Squared-error term from previous period affects the volatility of return of financial sector stock index ($\alpha_i \neq 0$). It is supported by the research of Butt $et\ al$. (2010) and Adesina (2013).

H8 Variance from previous period affects the volatility of return of financial sector stock index ($\alpha_i \neq 0$). It is supported by the research of Butt $et\ al$. (2010) andAdesina (2013).

4. Empirical Result

The first stages of this study is performing the pre-estimation test. Based on the result of stationarity and multicollinearity tests, the variables used in this study are stationary and have no problem of multicollinearity because the value of multicollinearity test on the independent variables is less than 0.8. The dependent variable has a problem of autocorrelation and ARCH effect, so that ARCH models and variations can be used as estimation method.The results are displayed in Table 1.

As previously described, the financial sector stock index is modelized with sixteen models and each model is compared based on the value of AIC, SC, and HQ. The selected model is GARCH (2,3) which has the lowest value of AIC and HQ. After obtaining the best model using ARCH variations, order (2,3) is tested using TGARCH and EGARCH method, then the three models are selected again based on the lowest value of AIC, SC, and HQ criteria.

Table 1. The result of pre-estimation tests

Pre-estimation tests	Probability	Information
Stationarity	0.0000	Stasionary
Multicollinearity	Lower than 0.8	Multicollinearity does not exist
Autocorrelation	0.0018	Autocorrelation exists
ARCH effect(lag 1)	0.0151	ARCH effect exists
ARCH effect (lag 3)	0.1136	ARCH effect does not exist

The chosen model is EGARCH (2,3) because it has the lowest value of AIC, SC, and HQ compared to TGARCH

(2,3) and GARCH (2,3). The abilityof EGARCH (2.3) to explain the model is quite good which is indicated by the adjusted r-squared value of 82.2%. This indicates that the variables used to analyze the return and risk in financial sector stock market are quiet good. Moreover, this model is able to explain the mean and variance equation well, as seen from the results of residual diagnostic tests in Table 2.

Table 2: The result of residual diagnostic tests

Tests	Probability	Information
Correlogram Q-stat	over 0.005	Good
Correlogram squared residuals	over 0.005	Good
Normality test	0.6417	Normal distribution
ARCH LM Test	over 0.005	ARCH effect does not exist

The following equations are the mean and variance equation from the best model of EGARCH (2,3):

$$r_t = 0.002 + 0.006EC_t + 0.019^*SMC_t + 0.287^{***}BIRATE_t$$
$$-0.164^{***}ER_t + 0.133^{***}IHK_t + 1.015^{***}IHSG_t$$
$$\log(\sigma_t^2) = -6.5^{***} + 1.5^{***}\left|\frac{\epsilon_{t-1}}{\sigma_{t-1}}\right| + 1.60^{***}\left|\frac{\epsilon_{t-2}}{\sigma_{t-2}}\right| + 0.15^{**}\frac{\epsilon_{t-1}}{\sigma_{t-1}}$$
$$-0.59^{***}\log(\sigma_{t-1}^2) + 0.48^{***}\log(\sigma_{t-2}^2) + 0.62^{***}\log(\sigma_{t-3}^2)$$

Information: The variable is significant at a critical value of *** 1%,**5%,and *10%.

Among the six variables used in the mean equation to explain the movement of return of financial sector stock index, five variables have a significant effect. Return of BI Rate, return of exchange rate IDR/US\$, and return of CPI or IHK, and return of JCI or IHSG have a significant effect at a critical value of 1%, while Subprime Mortgage crisis has a significant effect at a critical value of 10%.

The *dummy* variables of European crisis and Subprime Mortgage crisis have a positive relationship with the return of financial sector stock index, which is contrast with the hypothesis and previous studies. Research conducted by Tzeng and Tay (2014) found that the stock return is lower and its volatility becomes higher at the time of crisis.

The relationship between financial sector stock index and return of BI Rate is in contrary with the hypothesis but it is consistent with previous study conducted by Benakovic and Posedol (2010). An increase of BI Rate, generated by Bank Indonesia (BI), was triggered by the high amount of money circulating in the community. BI increases the BI Rate as a stimulus for people to invest, such as in the stock market. The increase in BI Rate is expected to cause an increasing demand for stocks, and higher demand cause an increasing of stocks price, and it causes increasing stock returns, and an increasing financial sector stock index.

The negative and significant effect of return of exchange rate IDR/US\$ is consistent with the hypothesis and research reference. Financial institutions rely on the performance of real sector, while the real sector is affected by the exchange rate. Due to the dependency on imported raw materials for production in real sector, appreciation of Rupiah (against US Dollar) will help the company reduce production costs, and this opportunity can pus the company to generate the higher

profits. The profit makes the company able to pay offits liabilities to financial institutions and it will improve the performance of financial institutions. An increasing performance of financial institutions can trigger a rise in stock prices and stock returns. Thus, it also trigger a rise in financial sector stock index.

Return of CPI has a positive effect on the return of financial sector stock index which is not aligned with the hypothesis, but these result is supported by previous study of Pilinkus and Boguslauskas (2009). An increase in consumer prices is a sign of a growing economy of a country, because the community can afford buying goods and services, so there is an incresing in the price level. This indicates a rise in companies' profitability in real sector that will increase the profitability of financial institutions. Increasing profitability of financial institutions will increase the stock prices and return of financial sector stock index.

Return of JCI's influence is consistent with the hypothesis and research reference. When JCI weakens, investors will withdraw their funds to be transferred to the more promising markets, such as the US capital markets.

Based on EGARCH (2,3) model, the variable of squared-error term from two previous periods and variance in one until three previous periods are used in analyzing the volatility risk. All six variables are significant at the critical value of 5%. This shows that the volatility in financial sector stock market happens in a quite long term and investors of stocks in financial sector tend to be resistant to shocks so that the shocks in the past, especially in the two or three previous periods, are still used as a rationale reason for investing in financial sector stock market.

In general, there is asymmetric volatility in financial sector stock market as seen from the coefficients which are significant at the critical value of 5%. The positive value of coefficients indicates that the schocks generated from good news would be greater than the shocks generated from bad news. This is a signal for investors to invest in financial sector stock market because positive sentiment (good news) will generate higher value of return compared to the declining value of return when negative sentiment (bad news) happens.

Conclusion

The movement of financial sector stock market, reflected from the movement of financial sector stock index, should be analyzed before hand because financial sector stock index could reflect the movement of stock return of issuers incorporated in financial sector. After being analyzed using the best model of EGARCH (2,3), the results show that the return of financial sector stock index is significantly influenced by five variables, namely Subprime Mortgage crisis, return of BI Rate, return of exchange rate IDR/US$, return of CPI, and return of JCI. Return of exchange rate has a negative impact on return of financial sector stock index, while the other four variables have a positive impact. European crisis has a positive but insignificant influence on return of financial sector stock index.

All six variables used to analyze the volatility are significant at the critical value of 5%. The volatility is considered as asymmetric volatility. It happens in financial sector stock market where positive sentiment (good news) generates a greater shocks than negative sentiment (bad news).

References

[1] Adesina, K. S. (2013). Modelling Stock Market Return Volatility : GARCH Evidence from Nigerian Stock Exchange. *International Journal of Financial Management*, *3*(3), 37–46.

[2] [BAPPENAS] BadanPerencanaan Pembangunan Nasional. (2011). KrisisKeuanganEropa: DampakterhadapPerekonomian Indonesia. Retrieved from http://www.bappenas.go.id/files/7013/5027/4514/revisi-krisis-eropa---30-des2011final__20111005055822__3444__0.pdf.

[3] Benaković, D., &Posedel, P. (2010). Do macroeconomic factors matter for stock returns? Evidence from estimating a multifactor model on the Croatian market. *Business Systems Research*, *1*(1), 39–46.

[4] Bollerslev, T. (1986). Generalized autoregressive conditional heteroscedasticity. *Journal of Econometrics*, 31,307-327.

[5] Butt, Z. B., Rehman, K. U., Khan, M. A., &Safwan, N. (2010). Do economic factors influence stock returns? A firm and industry level analysis. *African Journal of Business Management*, *4*(5), 583–593.

[6] Hameedu, M. S. (2014). Financial Inclusion - Issues in Measurement and Analysis. *International Journal of Current Research and Academic Review*, *2*(2), 116–124.

[7] Herve, D. B. G. H., Chanmalai, B., &Shen, Y. (2011). 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*, *6*(12), 146–169.

[8] Kuwornu, J. K. M., &Owusu-Nantwi, V. (2011). Macroeconomic variables and stock market returns: full information maximum likelihood estimation. *Research Journal of Finance and Accounting*, *2*(4), 49–63.

[9] Luo, Y. (2014). Economic Freedom, Financial Crisis and Stock Volatilities in Emerging Markets. *International Journal of Financial Management*, *4*(1).

[10] Muzindutsi, P., &Niyimbanira, F. (2012). the Exchange Rate Risk in the Johannesburg Stock Market the Exchange Rate Risk in the Johannesburg Stock Market : an Application of the Arbitrage Pricing Model, *8*(1), 60–71.

[11] Pilinkus, D., &Boguslauskas, D. (2009). The short-run relationship between stock market prices and macroeconomic variables in Lithuania: An application of the impulse response function .*Engineering Economics*, *5*(65), 26–3.

[12] [SETNEG] KementrianSekretariat Negara Republik Indonesia. (2009). Perekonomian Indonesia Tahun 2008 Tengah KrisisKeuangan Global. Retrieved from: http://www.setneg.go.id/index.php?option=com_content&task=view&id=3698.

[13] Singhania, M., &Anchalia, J. (2013). Volatility in Asian stock markets and global financial crisis. *Journal of Advances in Management Research*, *10*(3), 333–351.

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