The effect of dynamic relationship between domestic market and world market on stock returns volatility

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Abstract. The purpose of this study is to analyze the effect of dynamic relationship between domestic market and world market on stock returns volatility. To test this purpose, we use generalized autoregressive conditional heteroscedasticity (GARCH) model. In addition, dynamic relationship between domestic market and world market was measured by the dynamic conditional correlation (DCC) model. While conditional variance as measure for stock returns volatility was generated from variance equation of GARCH(p,q) procedure. The daily market indices data and their stocks prices over period from 01:01:2003 to 30:12:2016 were taken from China, Philippines, and world stock markets. Furthermore, the causality effect was also analyzed during the global financial crisis for period of 01:03:2008 to 31:03:2009. As the result, this study empirically suggests that the dynamic relationship between each domestic market and world market has a positive effect on stocks returns volatility. This evidence occurs in both overall sample period and during the global financial crisis period.

Keywords: stock market, dynamic relationship, DCC, GARCH, returns volatility.

1. Introduction

The issue of capital market integration has received a lot of attention from academics. In contrast to research on the effect of the capital market integration on stock returns volatility which is still relatively rare, including for emerging markets such as Philippines and Chinese capital markets. The integration could be reflected by the relationship among capital market returns movements. Theoretical framework of international portfolio diversification states that the higher the level of similarity of returns movements among capital markets, the lower the benefits of international investment activities. This is because efforts to minimize portfolio variance or stock returns volatility would no longer prevail.

Linkage between capital market integration and returns volatility has a varied explanation. One is that capital market liberalization often increases the relationship between local market returns and world market, but does not encourage local market volatility [1]. Another explanation of integration in the form of capital market liberalization that influences returns volatility is that integration raises a group of new investors who are mostly foreign institutional investors from developed markets. They have decisions based more on rational investment analysis and have strategies that focus on fundamental valuation factors so that the possibility of volatility is reduced [2]. On the other hand, an open stock market could also be entered by uncertainty reflected in increased stock returns volatility from another stock market which is integrated.
Financial liberalization by developed countries which is a stage of strengthening financial integration tends to reduce volatility and improve the level of informational efficiency. Another benefit is the decrease in the company's cost of capital ultimately could strengthen economic growth. However, in the short term, financial liberalization is often accompanied by a wave of crisis. Many stock markets receive systemic impacts and volatility spillover due to the delivery of information from other markets [3].

Consequence of financial liberalization and integrated financial markets into the world financial system is an increase in capital flows that have a real impact on the financial market economies of developing countries. On the one hand, it has a positive impact, namely this capital flow provides funding for many domestic investment projects because of insufficient domestic capital deposits. Capital flows are also an instrument in developing the domestic capital market. However, large-scale capital flows contain certain risks to recipient countries, especially when their financial systems are not sufficiently advanced and domestic macroeconomics and financial policies are weak or inconsistent [4].

Domestic investors who trade in markets that are integrated with the global financial system should pay more attention to the development of other capital markets, especially the most dominant markets. They will attempt to keep abreast of developments that occur in developed markets. However, for investors who only have low ability, they will carry out a minimum cost strategy to keep up with the developments. When the financial crisis and volatility occur in developed markets, they become panicked and quickly sell their shares. Their actions in the domestic market due to responding to what happened in the international market caused higher volatility in the domestic market. Such contagion effect have been evidenced in study of [5].

The basic theory of studies on international capital market integration is the modern portfolio theory fostered in the international context which contains securities diversification placed not only in the domestic capital market. The integration of capital market could make easier for international investors to allocate funds and have securities. Furthermore, the integration could make easier to create the expected returns and minimum risk. Therefore, the implementation of capital market integration is important for investors and policy makers.

For investors, the main consideration that is interesting lies in its implications on international portfolio diversification [6]. The integration influences the opportunity of international portfolio diversification which provide investors to allocate their capital efficiently [7]. For policy makers, the integration could help investors to expand base and reach of financial products so as to strengthen the domestic capital market to compete globally. In an effort to reduce the possibility of asymmetric shock, integrated financial markets could protect financial stability [16], develop economic capacity to withstand the shock and moderate the risk of financial transmission [18].

Determining how the capital market is indicated as an integrated market is by testing the level of arbitration activity in the long run. Capital market is integrated means that arbitration makes the capital market moves together in the long run and there are limited opportunities to create more than normal returns through international portfolio diversification. In contrast, the capital market is not integrated means that arbitration activity would not direct the capital market to move together in the long term and there is potential long-term returns through international portfolios diversification [7].

A number of studies show that Asian markets usually have low exposure to global factors and low integration with the western economy [8, 9]. In the last decade, China and ASEAN countries have become an important part of the international portfolio of fund managers,
because it helps them to diversify their portfolios which could reduce the portfolio risk [10].

Empirical study of [11] investigate dynamic convergence process among capital markets in China and ASEAN-5 countries using recursive cointegration analysis. The results show that six capital markets have more than one cointegration vector from 1994 to 2002. In general, regional financial integration between China and ASEAN-5 has gradually increased. The error correction coefficient between China and Indonesia is negative, while among China and the other countries is insignificant.

Financial literature examining on the effect of capital market integration on returns volatility shows different findings. The first findings show that market integration could increase volatility [12, 13]. The opposite findings, such as [14] state that financial liberalization does not have significant impact on volatility. In addition, [15] conclude that capital market integration does not cause excessive volatility in emerging markets and volatility decreases gradually due to the influence of financial liberalization. Furthermore, [16] state that the expansion of the investor base due to rising levels of liberalization led to a reduction in the total volatility of stock returns.

[19] state that if the national capital market is not perfectly positively correlated, investors could be able to reduce their portfolio variance without sacrificing their expected returns by diversifying international portfolios. Strengthening capital market integration by developed countries has a number of benefits, including risk diversification and reduced cost of capital. In addition, some previous researches report that financial liberalization tends to reduce returns volatility and improve the level of informational efficiency in emerging markets. These benefits will ultimately help strengthen a country's economic growth.

2. Materials and Methods

This empirical research observes companies listed on Philippines and China capital markets. Both capital markets are well-known as segmented capital markets from the global market and included in emerging markets which have different characteristics with the others in Asian region. The unit of analysis used is the daily stock price and market index with the sample period from 1 January 2003 to 30 December 2016. The samples are issuers that have higher level of liquidity and larger market capitalization on the Philippines Stock Exchange (PSE) and Shanghai Stock Exchange (SSE). As a proxy for world market index, we use the MSCI All Countries World Index.

The first step in analyzing this research is to determine the measure of relationship level between domestic market and world market. This measure is produced by the dynamic conditional correlation (DCC) model between each capital market observed with the world market. The DCC model was first proposed by [20] and had been applied by prior studies, [21] and [22], among others. The relationship level then acts as an independent variable for the returns volatility of the GARCH(p,q) model.

Returns volatility is obtained from the second equation of GARCH(p,q) model in the form of returns variance. Employing GARCH(p,q) model, it could be seen the significance of the influence from the relationship level between a domestic capital market and world market on returns volatility. Volatility is the spread of all possible outcomes in uncertain variables [23]. The measure of returns volatility in this study uses returns conditional variance. In addition to this measure, there are a number of alternative measures for volatility. In finance field, volatility often refers to a standard deviation (σ) or variance (σ^2) calculated from a set of
observations. Other measures include average absolute returns and inter-quantile range returns.

When the measures of returns volatility were compared, the time series model considered more sophisticated is the ARCH family. This ARCH model is extensively reviewed by [24] and [25]. Unlike the standard deviation models, ARCH models formulate the returns conditional variance through the maximum likelihood procedure. The first example of ARCH model is ARCH(q) proposed by [26]. Furthermore, GARCH(p,q) models proposed by [27]. Empirical findings indicate that GARCH is a more parsimony model than ARCH, and GARCH(1,1) is the most popular structure in most financial time series data. In addition, EGARCH, TGARCH which is similar to GJR-GARCH, QGARCH, and various other non-linear GARCH models were found. Mathematically, role of the relationship level as an independent variable on the returns volatility proxied by the variance was expressed by the GARCH equation.

The variance equation in GARCH(1,1) model used in this research added by dynamic conditional correlation (DCC) variable is expressed as follows:

$$
\sigma^2_{it} = \alpha_0 + \alpha_1 \varepsilon^2_{i,t-p} + \lambda_1 \sigma^2_{i,t-q} + \gamma_1 \text{DCCR}_W_{i,t}
$$

Where:

- $\sigma^2_{it}$: variance of GARCH(1,1) model as a proxy for returns volatility.
- DCCR$_W_{i,t}$: dynamic conditional correlation of returns between domestic capital market $i$ and the world market $W$ as a proxy for the relationship level.

3. Result and Discussion

To examine the effect of dynamic relationship level between domestic capital market and world market on stock returns volatility, the first step is to determine the values of dynamic correlation during the observation period. These values then become an independent variable for stocks returns volatility in the GARCH model.

For the overall sample period on Chinese capital market, the statistical estimation produces variance equation of GARCH(1,1) model as follows:

$$
\sigma^2_{it} = *0.002 + *0.053 \varepsilon^2_{i,t-1} + *0.942 \sigma^2_{i,t-1} + *0.864 \text{DCCR}_C_{N,t}
$$

The dynamic conditional correlation (DCC) coefficient is positive at 0.864 and significant at the 1% level with the daily sample period is 3375 observations. Estimation for the Chinese capital market indicates that the value of DCC coefficient as a proxy of relationship level is positive and statistically significant on conditional returns variance. This means that the level of relationship between Chinese capital market and world market has a positive effect on stocks returns volatility in this capital market. In other words, the higher the integration levels of Chinese capital market towards world market, the greater the returns volatility.

Variance equation of GARCH model for Philippines capital market is expressed as follows:

$$
\sigma^2_{it} = *0.162 + *0.254 \varepsilon^2_{i,t-1} + *0.434 \text{DCCR}_P_{L,t}
$$

The above estimate equation shows that the DCC coefficient is positive at 0.434 and very significant at the 1% level with daily samples period amounted to 3429 observations. Estimation result using GARCH model for Philippines capital market suggests that the value of DCC coefficient as a proxy of relationship level is positive and statistically significant to conditional returns variance. This means that the level of relationship between Philippines capital market and world market has a positive effect on volatility of stock returns in Philippines capital market. In other words, the higher the integration levels of Philippines capital market towards world market, the greater the returns volatility.
The next section reveals the analysis of the effect of relationship levels on returns volatility employing the stocks observed during the global financial crisis (GFC) period from March 3, 2008 to March 31, 2009.

Variance equation of GARCH(1,1) model for the Chinese capital market during the GFC period is expressed as follows:

\[
\sigma_t^2 = ***0.007 - ***0.045 \varepsilon_{t-1}^2 + ***1.022 \sigma_{t-1}^2 + **2.808 \text{DCCCN}_{t}^1
\]

Estimation result appears that DCC coefficient is positive at 2.808 and significant at the 5% level. Estimation result obtained in the Chinese capital market during the global crisis period indicates that the value of DCC coefficient is positive and statistically significant on conditional returns variance. This means that the level of relationship between Chinese capital market and world market has a positive effect on the volatility of stock returns. In other words, the higher the level of integration of Chinese capital markets towards world market, the greater the returns volatility.

Subsequent analysis was on the Philippines capital market during the global crisis period. The variance equation of GARCH model for this market is expressed as follows:

\[
\sigma_t^2 = ***0.349 + **0.259 \varepsilon_{t-1}^2 + ***3.775 \text{DCCRPL}_{t}^1
\]

Estimation equation from the GARCH(1,0) model on Philippines capital market shows that the value of the DCC coefficient is positive at 3.775 and statistically very significant at the 1% level to the conditional returns variance. This means that during global crisis period the higher the level of Philippines capital market integration towards world market, the greater the returns volatility.

The level of market relationship was analyzed its effect on the stock returns volatility applying GARCH(p,q) technique. Returns variance, as a measure of returns volatility, is generated by this technique and become a dependent variable in the second equation of GARCH(p,q) model. So, the returns variance in the regression analysis of GARCH(p,q) model is predictive values.

Estimate equations statistically suggest that dynamic conditional correlation, as a measure of the relationship level, has a positive effect on returns variance. This statistical evidence is the result of regression analysis using GARCH(p,q) model conducted through four tests. The details are testing of both Chinese and Philippines capital markets for the entire sample period and for the GFC sample period. The result indicates that the relationship level generally has a positive effect on returns volatility.

The positive direction of coefficient on the relationship level is in accordance with the existing logical framework that the higher the level of relationship among capital markets, the higher the returns volatility. However, this logical framework contradicts the theoretical framework of market integration in the process of financial liberalization which fundamentally the integration should has a negative effect on returns volatility. Several prior studies report that strengthening financial integration tends to reduce returns volatility and to improve the level of informational efficiency.

The findings of this study are similar to arguments of [12] and [13] which reveal that market integration with its liberalization process could increase volatility. The different findings are found in the study of [14] which states that financial liberalization, as part of financial integration in terms of eliminating institutional restrictions, has no significant impact on volatility. The opposite findings are found in the conclusion of [16] suggesting that the expansion of the investor base due to rising level of liberalization causes a reduction in the total volatility of stock returns. In addition, [15] conclude that market integration does not
cause excessive volatility in emerging markets and volatility decreases gradually due to the influence of financial liberalization.

In addition, [14] provides information about the level of integration should have a negative impact on the returns volatility. They argued that implementation of financial liberalization, as one of the stages of financial integration realization, by developed countries had a number of benefits, including the application of risk diversification, reduction in cost of capital, and informational efficiency. These benefits have great potential to help strengthen economic growth. Implementing such policies in emerging markets has a number of consequences.

4. Conclusion

Statistical testing step applying GARCH(p,q) technique on the influence of dynamic conditional correlations on the conditional returns variance generates similar result for the overall sample and during the global financial crisis periods. It suggests that the relationship level of a capital market to global market has a positive influence on the volatility of stock returns. Employing the stocks prices and market indices, this evidence occurs in both Chinese and Philippines capital markets.

This conclusion contradicts the theoretical framework of market integration in the process of financial liberalization which fundamentally should negatively affect returns volatility. In other words, strengthening financial integration tends to reduce the returns volatility. Another explanation supporting this framework suggests that integration raises a group of new investors. Most of them are institutional foreign investors from developed markets. They have decisions based more on rational investment analysis and have strategies that focus on fundamental valuation factors so that the possibility of volatility decreases.

In contrast, evidence of this study affirms another theoretical framework of volatility spillover and contagion risk. It states that volatility spillover and contagion risk could occur among capital markets which could increase returns volatility. Capital markets are often accompanied by a wave of crises and they receive systemic impacts and volatility spillovers due to the delivery of certain market information from other markets. Therefore, the level of capital market integration during a crisis period has a positive effect on returns volatility. At the time of crisis, when the level of integration is higher, then it was followed by the higher stock returns volatility. Higher relationship of returns between a domestik capital market and world market could increase stock returns volatility and this is interpreted as evidence that supports the contagion hypothesis.

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