Multivariate GARCH Volatility Across Major Industry Groups of the Stock Exchange of Thailand

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This paper examines the volatility on the time-series relations among the returns of industry group indices in the stock exchange of Thailand. Does volatility of the return series in one industry group indices necessarily lead to volatility in other industry group indices among the sample of eight industry groups? This research will be valuable to investors utilizing a better understanding diversification needed to get good returns. Daily data (2,116 days) are used in this paper covering data for the nine-year period from January 5, 2004, to August 31, 2012. Multivariate Generalized Autoregressive Conditional Heteroscedasticity was tested consisted of: (1) Diagonal VEC Model; (2) Baba Engle Kraft Kroner Models (BEKK Models); (3) Vector Autoregressive Moving Average GARCH Model (VARMA GARCH Model); and (4) Constant Conditional Correlation Model (CCC Model). The findings indicated that the major result shows that, volatility in one industry group necessarily lead to volatility in other industry group indices in the opposite way and in the similar way.

Keywords: volatility spillover, standardized shocks, stock index returns, conditional correlations

Risk-Adverse Investor in the Stock Exchange of Thailand

Risk-adverse investor in the stock exchange of Thailand has high (low) risk attitudes. Hence, under an efficient decision needed to make as optimal a decision, Investors has higher expected utility to compensate for extreme variability. It is notable that in the long run, one of industry group indices returning to the equilibrium is faster than others. In case of consumer production industry group is slower than the others. Does volatility of the return series in one industry group indices necessarily lead to volatility in other industry group indices among the sample of eight industry groups?

Volatility in Returns of Industry Group in the Stock Exchange of Thailand’ Predictions

We contend that the volatility on the time-series relations among the returns of industry group indices in the stock exchange of Thailand.

Theory and Hypothesis

The four volatility patterns of SET industry group indices consist of: (1) Diagonal VEC model; (2) BEKK model; (3) VARMA GARCH model; and (4) CCC model. All of the models are the Multivariate GARCH model and models can be expressed as follows:

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MULTIVARIATE GARCH VOLATILITY ACROSS MAJOR INDUSTRY GROUPS

(1) Testing stationary data to check out tradable stock market volatility index returns by Diagonal VEC model using a volatility model:

\[ H_{st} = C_0 + \sum_{k=1}^{K} A_k \otimes (\varepsilon_{st-k} \varepsilon_{st-k}') + \sum_{k=1}^{K} B_k \otimes H_{st-k} \]

(2) Testing the volatility of the tradable stock market volatility index returns suggested by Baba, Engle, Kraft and Kroner model or BEKK models used to test the model is BEKK models.

\[ H_{st} = C_0 C_0' + \sum_{k=1}^{K} A_k \varepsilon_{st-k} \varepsilon_{st-k}' A_k + \sum_{k=1}^{K} B_k H_{st-k} B_k \]

(3) Test the volatility of the index returns on industry group indices in the stock exchange of Thailand by Vector Autoregressive Moving Average GARCH (VARMA GARCH). The model used to test VARMA GARCH models is (Serletis & Shahmoradi, 2006; Tomasz, 2012):

\[ H_{it} = \omega + A_t \tilde{\varepsilon}_{t-1} + B_t H_{t-1} \]

(4) Test the volatility of the index returns on industry group indices in the stock exchange of Thailand by Constant Conditional Correlation model. Generally, Covariance Matrix \((\sum_k) k \times k\) can be placed in the form below which \(R\) is Constant Conditional Correlation Matrix and \(\Lambda_t\) is Diagonal Matrix.

\[ \sum_t = \Lambda_t R \Lambda_t \]

Data Description

Daily index returns on industry group indices in the stock exchange of Thailand were to further examine dependence covered eight group total market capitalization of industry’s volatility. Daily data are used in this paper covering data for the nine-year period from January 5, 2004, to August 31, 2012 (2,116 days). There are eight industry group indices (divided into 25 sectoral indices): (1) Agro and food industry (A); (2) Consumer productions (C); (3) Financials (F); (4) Industrials (IND); (5) Property and construction (PR); (6) Resources (R); (7) Services (S); and (8) Technology (T).

Research Method

The stock exchange of Thailand compiled the index to weigh the performance of the industry groups. The results from first three models show that there are similar volatility spillover effects on index returns on industry group indices. Moreover, VARMA GARCH model also has not only transmission patterns of standardized shocks but also the adaptation of the long term after transmission patterns of standardized shocks. Conversely, Diagonal VEC model considers the only volatility spillover from the stock return index of each industry at once in the past to the return index of the same stock in the present.

The last model is CCC model, which is the study of volatility spillover to the constant conditional correlation of standardized shocks. The reason that Diagonal VEC model and CCC model have only the appearance of volatility spillover is both do not take external standardized shocks to study. In actually, standardized shocks have the impact on the volatility of the return index of stock, for example, internal and external factors of industry, information such as political situation, economy, and environment, performance of company, value, and technology. Thus, the study brings the result of BEKK model and VARMA GARCH to conclude because both models can be explained about volatility better than Diagonal VEC model and CCC model. The result shows that, in the study about the volatility spillover in the case of spillover from the future to the future. The BEKK model was tested to explore the nature of the return and volatility spillover effects.
Group indices for resources industry and consumer products industry tend to react in the opposite direction with a highest coefficient value that is equal to 18.0751 percent. Consumer productions industry group indices spill to service industry group. A lowest value that is equal to 4.05122 percent of standardized shock.

It represents that if the resources industry group has high volatility, it will make consumer production group has low volatility that will be equal to 18.0751 percent in the future. In the same way, if consumer production group has high volatility, it will cause services group to have low volatility that is equal to 4.05122 in the future.

From these results, it is possible that resources group has price fluctuation because stock price always depends on external markets. This attracts speculative investors because it is not only yield high returns, but also gives high profit from the difference in price in a short time.

Table 1

<table>
<thead>
<tr>
<th>Volatility spillover (VS)</th>
<th>% of the relation</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{t+1}$</td>
<td>$C_{t+1}$</td>
<td>-18.0751</td>
</tr>
<tr>
<td>$F_{t+1}$</td>
<td>$C_{t+1}$</td>
<td>-15.562</td>
</tr>
<tr>
<td>$I_{t+1}$</td>
<td>$C_{t+1}$</td>
<td>-13.6168</td>
</tr>
<tr>
<td>$Pr_{t+1}$</td>
<td>$C_{t+1}$</td>
<td>-12.5675</td>
</tr>
<tr>
<td>$St_{t+1}$</td>
<td>$C_{t+1}$</td>
<td>-12.2352</td>
</tr>
<tr>
<td>$At_{t+1}$</td>
<td>$C_{t+1}$</td>
<td>-9.7772</td>
</tr>
<tr>
<td>$It_{t+1}$</td>
<td>$St_{t+1}$</td>
<td>-7.85083</td>
</tr>
<tr>
<td>$Ct_{t+1}$</td>
<td>$St_{t+1}$</td>
<td>-4.05122</td>
</tr>
</tbody>
</table>

Note. Source: From calculation.

Unlike consumer products group, this is hardly increasing in price of stock. It causes some investors to sell stock in this industry and buy stock in resources group instead. Services group is a group which relates to some divisions of stock in consumer productions group such as commerce division and division of transportation and logistics. So the consumer products group results transmission patterns of consumer production group to the services group slightly.

Table 2

<table>
<thead>
<tr>
<th>Volatility spillover (VS)</th>
<th>DV</th>
<th>Coef.</th>
<th>Standard shocks</th>
<th>DV</th>
<th>Coef.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Pr_{t-1}$</td>
<td>$C_t$</td>
<td>2.0540</td>
<td>$S_{t-1}$</td>
<td>$F_t$</td>
<td>$F$</td>
</tr>
<tr>
<td>$Tr_{t-1}$</td>
<td>$C_t$</td>
<td>1.8560</td>
<td>$A_{t-1}$</td>
<td>$S_t$</td>
<td>$S$</td>
</tr>
<tr>
<td>$Ft_{t-1}$</td>
<td>$C_t$</td>
<td>1.5765</td>
<td>$S_{t-1}$</td>
<td>$Pr_{t}$</td>
<td>$Pr$</td>
</tr>
<tr>
<td>$Cr_{t-1}$</td>
<td>$F_t$</td>
<td>1.2877</td>
<td>$T_{t-1}$</td>
<td>$S_t$</td>
<td>$S$</td>
</tr>
<tr>
<td>$Ar_{t-1}$</td>
<td>$A_t$</td>
<td>1.2312</td>
<td>$T_{t-1}$</td>
<td>$C_t$</td>
<td>$C$</td>
</tr>
</tbody>
</table>

Note. Source: From calculation.

In the case of spillover from the part to the present, this study found that the VARMA GARCH shows the property and construction industry group spills the volatility to the consumer productions industry group with the most coefficients which is equal to 2.0540 and there is the volatility spillover from the consumer productions industry group to the agro and food industry group with the least coefficients which is equal to
1.2312. It represents that if the return stock index of property and construction group has high volatility in the past, it will cause the return stock index consumer productions to have low volatility which is equal to 2.0540 in the present. In the same way, if consumer productions had high volatility in the past, it will cause the agro and food industry to have low volatility which is equal to 1.2312 to the present. From both of models conclude that the consumer productions industry group is the group that always receives the volatility spillover from the others. It represents that, consumer productions receive the most volatility from other industries since this industry has the most relation between other industries. The product in this industry group is secondary product and it needs to product from other industries to complete. It may be the cause that the stock receives the most volatility from other industries. For the study about the transmission patterns of standardized shocks, in the case of the same industry, there are the transmissions of standardized shocks in the industry group of agro and food industry with the most coefficients which are equal to 0.2615 and the financial industry group with the least coefficients which are equal to 0.1681. When there is some present information which might be advantage or disadvantage to the volatility of the return index of each stock. The industry group of agro and food industry will spill the most volatility which is equal to 0.2615 in the industry group because an agro and food product has the relationship between other industries and it relies on the domestic market and international market, so the present external factors or information will have the impact on this industry in the future, for example, exchange rate, the interference of the government, flooding and other natural disasters, etc.. In contrast, financial group spills over the less volatility which is equal to 0.1681 due to the present information because it depends on the performance and management of each company in each category of stock. In case of transmission patterns of standardized shocks between industries, it found when the shock happened in the part and effect to the transmission patterns in the present. The most transmission patterns of services group to financial group which is equal to 0.4955. This may be caused by services group needs in financial service industry to invest in service sectors.

In case of transmission patterns of standardized shocks to other groups, when the shock happened in the part and effect to the transmission patterns in the present, including property and construction industry group and industrials industry group because both are the common factor in both industrial production and construction of all other industries. In addition, this study found that in the long run, the industrials industry group is the group that can return to the equilibrium faster than the others and the consumer productions industry group slower than the others. The reason could be the manufacturing industries. Industrals industry group is a fundamental factor in the production of many industries. Conversely, the consumer productions group gets the most volatility from all other industries. So it causes adapt slowly to the equilibrium.

Table 3

Results of Comparison in the Most of Spillover Standardized Shocks and Long-Run Adjustment From Each Model

<table>
<thead>
<tr>
<th>Models</th>
<th>Volatility spillover (VS)</th>
<th>Standard shocks</th>
<th>Long-run adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\gamma_1$</td>
<td>$\gamma_2$</td>
<td>$\delta_1$</td>
</tr>
<tr>
<td>DVEC</td>
<td>IND</td>
<td>IND</td>
<td>-</td>
</tr>
<tr>
<td>BEKK*</td>
<td>R</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>VARMA*</td>
<td>Pr</td>
<td>C</td>
<td>S</td>
</tr>
<tr>
<td>CCC</td>
<td>Pr</td>
<td>F</td>
<td>-</td>
</tr>
</tbody>
</table>

Notes: * are the models that the study brings the result to conclude. Source: From calculation.
Conclusions

The paper examines volatility spillover effects on return series or errors from the CCC model and Diagonal VEC model by fitting a multivariate model. The findings found that high reverse formation of a cross-industry group is significantly increased linkage between resource industry group and consumer production industry group. In the study, the volatility of resource industry group spills to consumer production industry group with a highest coefficient value. A lowest standardized shock coefficient transmits in consumer productions industry group to service industry group.

The findings indicated that the same directional volatility spillover in property and construction industry group to the consumer productions industry group. The significant volatility spillover effects become apparent in property and construction industry group. In conclusion both of models represent that consumer productions industry group linkage with high coefficients. Spillovers are found in industrial groups with a high degree of competition. Numerous significant spillover coefficients of consumer production industry group and other groups were found.

The findings show evidence that of future transmission patterns of standardized shocks in agro and food industry group with highest coefficient and in a financial industry group with lowest coefficient.

The findings show evidence that standardized shocks transmit from the past to the present within the same industry group. A highest standardized shock coefficient to be transmitted in agro and food industry group indicates likely to be strong performances. A lowest standardized shock coefficient to be transmitted in financial industry group shows likely to be weak performances.

Standardized shocks transmit from the past to the present in the different kind of industries. A highest standardized shock coefficient transmits in services industry group to financial industry group. Property and construction industry group and the industrials industry group always perform the standardized shocks transmit to other groups.

Furthermore, in the long run, industrials industry group adjusts to return to equilibrium faster than other groups. And consumer production industry group adjusts to return to equilibrium slower than other groups.

References


