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# The contagious effects analysis of Chinese Equity Market to South Asia's emerging financial markets

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## Abstract

To study the contagious effects of financial risks in South Asia's emerging stock markets, the main stock indexes from China, Thailand, India, Vietnam and Malaysia are chosen during the period from 2006 and 2014. The paper used the dynamic conditional correlation GARCH model to examine the dynamic relevance, and introduced the dummy variable in order to test whether the structure change had occurred after the global financial crisis. The results showed that the degree of relevance of China, Thailand, India and Malaysia stayed in the high level. However, the Vietnam hardly had a dynamic relevance with other emerging markets. This indicated that the Vietnam stock market has apparent market segmentation with other markets, no matter which aspects we considered the dynamic correlation or the financial crisis contagion. At last we build models to analyze the relations between the dynamic conditional correlation of BSE & SSEC and macro-economic. The main reason is to understand which aspects may impact correlation. From the test results, we realize the India GDP and total export-import volume has a positive relation with the correlation, while China's corresponding indexes has a negative impact on it. In the end, according to the results we got, the investors should pay more attention to the relevance between emerging countries, so that the idiosyncratic risks can be avoided. As for the supervision department, they should reinforce the stock market which has a higher correlation in order to guarantee the stable development of financial markets.

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# 1 Introduction

With the end of quantitative easing policy in the United States, the flow of emerging market funds began to reverse, which directly induced the stocks to fall sharply in some areas, coupled with the inherent problems of some emerging markets, macroeconomic and structural problems, so that the risk of these economies in the international financial turmoil pattern of mutual interconnection and transmission problem is more important. The model of Y Hamao, RW Masulis and V Ng (1990） has proved that the stock markets in United States, UK and Japanese exist spillover effect, and the spillover effect of Japanese is the weakest among these three countries. However, this kind of research method has divided the whole market into segmentation, so it lost the useful information in the correlation among different markets.

Brian Lucey (2007）used the DCC-GARCH model to analyze the 7 markets in Latin America and its regional markets and the market in the United States, with a purpose of studying the influence on their correlation with the international market arising from financial liberalization of the main countries of Latin America in 1990s. The results showed that the regional integration and global integration of some countries with emerging markets in Latin America are both not obvious. For the United States and other international investors, it is feasible that long-term international diversification investment can be carried out in Latin America emerging markets.

Similarly, Balazs Egert and Evzen kocenda（2007）also used the DCC-GARCH model to study the correlation among three mature market countries (France, Germany, UK) and three emerging market countries(Czech republic, Hungary, Poland) in Europe. The results suggest that the correlation between Germany and France, Germany and the UK, France and Britain is relatively large, while the correlation between other markets is small.

Juan Carlos Rodriguez（2007）employed Markov to transfer parameters of Copula and build a model of dependence, which studied financial contagion problem of five stock markets in East Asia (Taiwan, Malaysia, Indonesia, South Korea, Philippines) and four in Latin America (Argentina, Mexico, Brazil, Chile) during the Asia financial crisis and the Mexico financial crisis; it was found that the dependence structure of stock market in the financial crisis had changed. Syllignakis and Kouretas (2011) used the weekly data of stock market(1997-2009) combined with DCC - GARCH model to analyze the relationship among the United States, Germany, Russia and Eastern Europe and the Soviet Union Fund (CEE) stock markets and the effect of infection. The result showed that the correlation among the United States, Germany and Germany shares was obviously apparent, during the international financial crisis from 2007 to 2009; in the face of

domestic and foreign monetary policy, exchange rate policy shocks, the co-movement effect of new shares is significantly affected. Aloui、Aissa and Nguyen (2001) employed Copulas model to make an empirical study on the correlation between the BRICs and the American stock markets, it was found that there is a strong correlation between the markets; especially the paired stock market is related in higher order, whether in bull or in a bear market. Dimitrios dimitriou（2013）employed FIAPARCH—DCC model to study the interconnection effect of BRICS stock markets in the different stages of the financial crisis from 1997 to 2012; the empirical results showed that the BRICS market is independent of each other in the initial stage of the crisis. With the spread of the crisis, the correlation among stock markets in 2009 had gradually increased, and the interconnectivity in the bull market is obviously higher than that in the bear market.

In domestic research, Hong Yongmiao, Cheng Siwei, Liu Yanhui, Wang Shouyang (2004) introduced a measure using the risk of Grainger causality for studying the Extreme Risk Spillover Effect between the Chinese stock market and other stock markets in the world. The results show that there was a strong risk spillover effect between A shares and B shares, which can be adopted to predict the possibility of a sharp fall of A shares in the future once the B shares fall sharply; at the same time, although there was a certain risk spillover effect between A shares and South Korea, Singapore stock market, it was showed that there was no risk spillover effect existing between A shares and major stock markets in the world such as Japan, the United States and so on. Wang Yuanlin (2006) made an empirical study about the co-movement effect among stock markets based on the SSE Composite Index and the related data of main international stock markets during 2006 to 2009; it is found that there was no long-term equilibrium relationship existing between the Chinese stock market and other major stock markets; simultaneously, the SSE Composite Index is very sensitive to the impact of American stocks. Zhao Hua (2009) used the multivariate GARCH model to carry out empirical research on the risk contagion among five regions, including Europe, Asia Pacific, America, Europe, and Africa; the results suggested that there was a remarkable double track volatility spillover effect among Europe, the United States and the Asia Pacific region, and there was a one-way volatility spillover effect from the Asia Pacific to Europe, while there was no volatility spillover relationship between Africa and Asia Pacific. Zhou Yunfan (2010) investigated the co-movement of the major stock markets in the Southeast Asia region before and after the outbreak of the financial crisis with the help of co-integration test, Grange causality test and VAR model; according to the results, Zhou found that the domestic stock market was little influenced by peripheral stock markets, but the financial crisis made the Chinese stock market's influence on the peripheral market increase; however, compared to Japan, the influence of Chinese stock market towards Southeast Asia was still weak. Based on the static and dynamic Copula function, Liu Ping and Du Xiaorong (2011) analyzed the related structure changes of three financial markets between

China and the United States in the past 20 years, namely before and after lately twice financial crisis; specifically, they made a comparative analysis for the contagion effect and transmission route of financial risk, and came to a conclusion that the correlation among the three markets was not so significant in the 1997 crisis and the contagion effects did not happen, but in 2007, the correlation of the three markets increased significantly with the relevance of a significant change. According to GO-GARCH model, Chen Zhiqiang and Lin Siyuan (2011) studied the risk spillover effect between the Shanghai, Taiwan, Hong Kong stock markets and Southeast Asia's main stock markets from two different level, including within day and between days, revealing the information transmission mechanism between the two regions; the results showed that Hong Kong was the main information export market towards Southeast Asia among three stock markets referred before, while Singapore had the most influence on the market of three place, which simultaneously suggested that although there were some channels of information exchange between the two regions, the phenomenon of market segmentation was the still significant. Through studying Chinese, Japanese and South Korea's stock index, Gao Meng, Guo Pei (2012) found that there was little co-movement between Chinese and Japanese stock market or Chinese and South Korea's stock market, but it was seen that there was an increasing co-movement between Chinese and South Korea's stock, and the co-movement of stock markets between Japan and South Korea was higher than that between Chinese and Japanese or Chinese and South Korea; what's more, the market presented certain trend of integration. Geng Qingfeng (2013), selecting the yield rate time series of the GEX index and the small and medium-sized board index, calculated the dynamic correlation coefficient between the two markets by using the DCC GARCH model and the Copula model respectively; due to his study, Gao found that there were positive correlation between the gem and the small and medium-sized board market, and the correlation was very strong and stable.

At present, most of the literature on the co-movement of the stock market is concerned with the relationship between China and the mature financial markets. In this paper, we select the data of the financial crisis in 2008 as the sample period statistics, and then study the co-movement performance among stock markets in emerging countries and transfer effect of the financial risk in the countries before and after the outbreak of the financial crisis. On the choice of sample, we conduct a comprehensive selection with representative stock index in emerging market countries, while previous study paid more attention on stock index between China and mature markets; on the selection of time, it contains the global financial crisis in 2008, which makes it possible to better respond to the stock market development trend of emerging market countries in recent years, and therefore we can provide investors with more accurate information; on the choice of index , we select representative composite stock index of every emerging market countries; when it comes to research methods, by using dynamic conditional correlation coefficient, we can attain

better reaction of correlation effect on stock market when condition changes in different periods. With the rapid development of emerging economics, the utility spillover and risk spread of emerging market countries gradually arouse the concern of the world; at the same time, as a powerful emerging economy, our country should focus more on its market's direct co-movement property, thus we can provide accurate and timely information for the external supervision and internal control of the financial field. This paper is divided into three sections. In section 1 we review relevant literature and research methods. Section 2 gives a detailed introduction of the theoretical model and the empirical data used in this paper. In section 3 we show the results of the empirical analysis and related significance. The last section is the conclusions.

# 2 Theoretical Model and Empirical Data

## 2.1 Model Specification

We consider a logarithmic price vector $P_t = (p_1, p_2, \ldots p_n)$ containing $N$ assets, and assume that it obeys the Generalized Wiener Process of a multivariate continuous time: $dP_t = u_t dt + \Omega_t dB_t$ , of which $u_t$ is drift vector, $\Omega_t$ represents a $N \times N$ dimension positive definite diffusion matrix, $B_t$ is a standard Brown movement for $N$ dimension. Besides, we define that yield rate vector of $N$ assets in time length $h$ is $r_{t+h,h} \equiv P_{t+h} - P_t$ , and time varying volatility model considers the elements in the $\Omega_t$ diagonal is a function of time and provides us with estimation method, but in time varying correlation coefficient model, the element in the triangle matrix below $\Omega_t$ is also a function of time. In particular, as for DDC-GARCH model, the estimated value $H_t = \sum_{i=1}^{n} r_t r_t^{'}$ of matrix $\Omega_t$ can be decomposed into the product of two factors, including the correlation coefficient matrix $R_t$ and diagonal matrix composed of standard deviation $D_t$ , namely $H_t = D_t R_t D_t$ . Then we can attain the estimated value of time varying standard deviation diagonal matrix $D_t$ through standard GARCH model, thus the estimated value of correlation coefficient matrix $R_t$ can be obtained by the standardized residuals of GARCH model. The complete model is defined as follows:

Assume that asset portfolio's yield rate $r_t = [r_{1t}, r_{2t}, \cdots, r_{nt}]$ obey the dynamic stochastic process as following:

$$\begin{aligned} r_t &= \mu_t(\theta) + \varepsilon_t \\ \varepsilon_t \,|\Omega_{t-1} &\sim N(0, H_n) \end{aligned} \qquad (1)$$

In Equation (1) $\Omega_{t-1}$ is information set at time $t$, $H_t$ is time-varying covariance matrix. Based on multivariate statistical knowledge, we divide the conditional covariance matrix $H_t$ into the product of correlation coefficient matrix $R_t$ and diagonal matrix $D_t$

composed of the standard deviation, namely $H_t = D_t R_t D_t$ .

$$\begin{aligned} & r_t \left| \Omega_{t-1} \right. \square N\left(0, H_t\right) \\ & D_t = diag\left(\sqrt{h_{11,t}}, \sqrt{h_{22,t}} \cdots \sqrt{h_{nn,t}}\right) \end{aligned} \quad (2)$$

The standardized residual vector is $Z_t = D_t^{-1}\varepsilon_t$ ; time varying standard deviation matrix is $R_t = \left(Q_t^*\right)^{-1} Q_t \left(Q_t^*\right)^{-1}$ , of which there is $Q_t^* = diag\left(\sqrt{q_{11,t}}, \sqrt{q_{22,t}} \cdots \sqrt{q_{nn,t}}\right)$ .Engle[10] defined the dynamic difference in the process of DCC-GRACH as follows:

$$\begin{aligned} Q_t &= \overline{Q} + \sum_{m=1}^{M} \alpha_m \left(Z_{t-m} Z_{t-m}^{'} - \overline{Q}\right) + \sum_{n=1}^{N} \beta_n \left(Q_{t-1} - \overline{Q}\right) \\ &= \left(I_n - \sum_{m=1}^{M} \alpha_m - \sum_{n=1}^{N} \beta_n\right) \overline{Q} + \sum_{m=1}^{M} \alpha_m Z_{t-m} Z_{t-m}^{'} + \sum_{n=1}^{N} \beta_n Q_{t-1} \end{aligned} \quad (3)$$

Where $\overline{Q}$ is the unconditional covariance matrix based on the calculation of standardized residuals, and there exists $\overline{Q}=\mathrm{T}^{-1}\sum_{t=1}^{T} Z_t Z_t^{'}$, of which $Q_t$ is the dynamic covariance matrix of standardized residual vector. $\alpha_m$ represents the standardized residual square coefficient in multivariate GARCH model during the early-mid period, which reflects the influence produced by the product of standardized residuals in the early time on the dynamic correlation coefficient; $\beta_n$ is the dynamic correlation coefficient in the early time, which represents the duration of dynamic correlation. There exists a numerical condition about the two coefficients referred above, which is $\alpha_m \geq 0, \beta_n \geq 0$ .Because of the long-term average variance, $\sum \alpha_m + \sum \beta_n < 1$, and they are equipped with the nature of consistency and asymptotic normality.

## 2.2 Data Characteristic

In this section, we mainly analyze the risk co-movement relationship among Shanghai Securities Composite Index (SSEC), India SENSEX Index (BSE), Stock Exchange of Thailand (SET), Kuala Lumpur Composite Stock Price Index (MKLCI) and Vietnam Hu Zhiming's Stock Exchange Index (VN). Because there is a strong correlation between the Shanghai and Shenzhen stock markets, it is reasonable to regard the SSEC as representative of mainland stock market; simultaneously, India, Thailand, Malaysia and Vietnam are the major economies of Asia's emerging market countries, so we can use BSE, SET, MKLCI and VN to analyze the market interconnection and risk contagion in emerging market countries. We used the daily closing price of SSEC, SET, BSE, MKLCI and VN as sample. In our paper, these sample data are all from Bloomberg database, and the time window is from January 1, 2006 to January 1, 2014. If the very day is lack of transaction data, the closing price of last trading day will be used as the closing price of that day. Finally, we attain 2923 sample data.

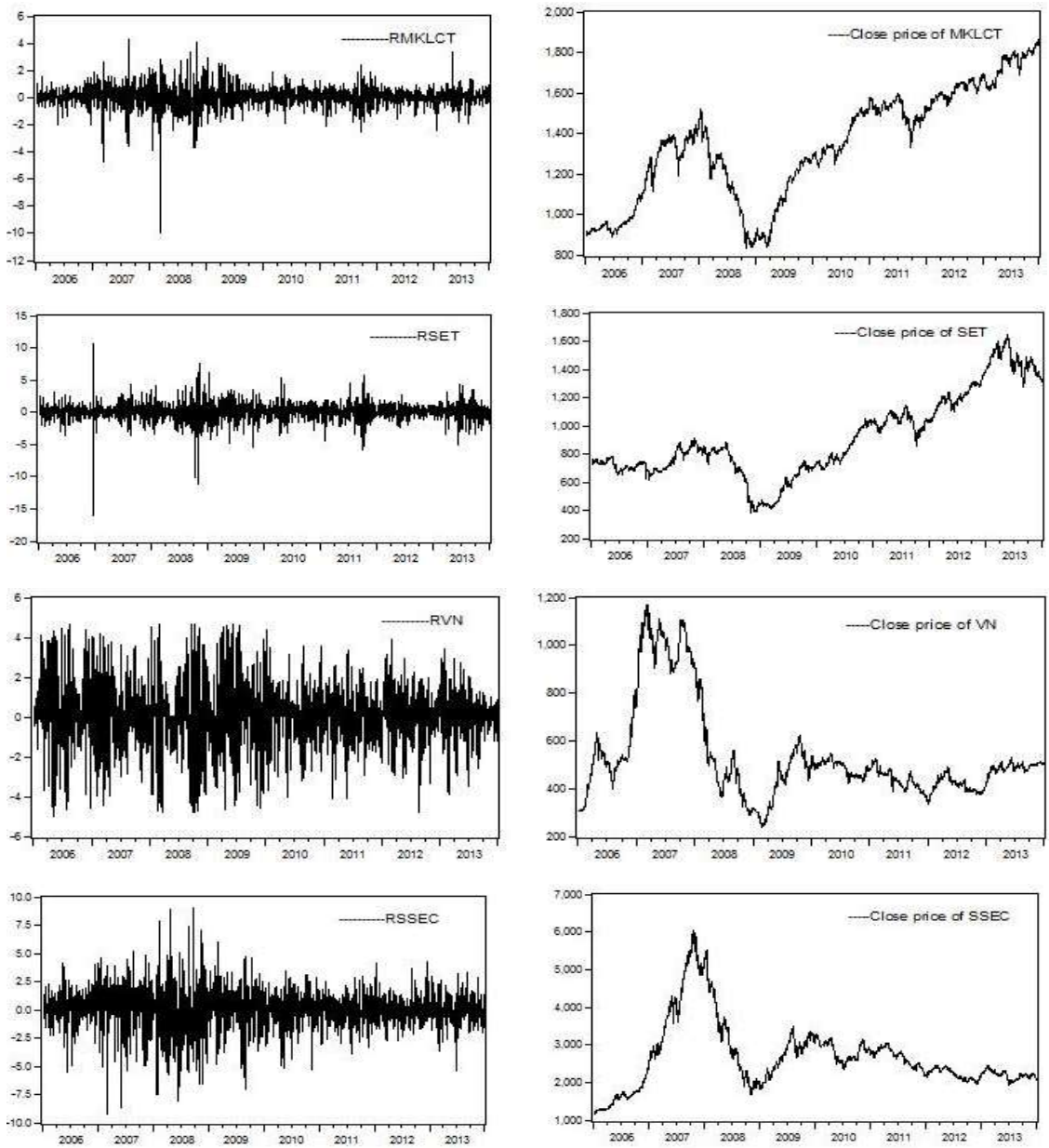


Figure1. Dynamic graph of five countries' composite index yield rate and stock index in the sample period

Combined with Figure1, it can be directly seen that during the global financial crisis in 2008, five countries' composite stock index showed a sharply rise and a sharply decline like the V type. On the contrary, after 2009, the composite stock index of three countries, including India, Malaysia, Thailand, was back to the high position, and it kept fluctuating at the high point; while the stock index of China and Vietnam had been in volatility at the low point after a slight rebound. As the response to the financial crisis, the FED had carried out a quantitative easing monetary policy to push up the global assets' prices, so

that the stock markets of the world could recover. As for our country, on the one hand, we are faced with the pressure arising from slow-grow economy, and the reflection of asset market towards the reduction of economic expectation is slightly over; on the other hand, the accumulation of bubble before the outbreak of global financial crisis was being squeezed, resulting in the a stage of SSEC after the crisis. However, at this time, the stock market became more and more like a barometer. In contrast, although five countries were facing with high inflation at the same time, due to its rapid economic growth, India, Thailand, Malaysia have promoted its stock markets to present a good situation; specifically, their success was owing to a variety of reasons, such as no credit to leave the huge risk, no need to regulate and control the real estate bubble, especially the rapid development of tourism services and so on. Compared to the other four emerging economies, the overall economic development of Vietnam was the slowest, and its stock market was in its infancy, so the whole market presented to be in downturn after the financial crisis.

Table1 Summary about the statistical properties of sample index data

| | SSEC | BSE | SET | VN | MKLCT |
|---|---|---|---|---|---|
| | Basic descriptive statistics for the yield rate of the whole sample index | | | | |
| Mean value | 0.02 | 0.03 | 0.03 | 0.02 | 0.03 |
| Standard deviation | 1.44 | 1.41 | 1.19 | 1.42 | 0.67 |
| Skewness | -0.46 | 0.46 | -1.21 | -0.10 | -1.48 |
| Kurtosis | 9.38 | 18.84 | 24.93 | 5.05 | 26.22 |
| | Unit root, self-correlation and variance test statistics for the yield rate sequence of the whole sample index | | | | |
| ADF | -57.44*** | -53.51*** | -56.23*** | -26.88*** | -49.43*** |
| $Q(5)-R$ | 0.04*** | 3.42 | 18.73*** | 129.94*** | 36.10*** |
| $Q(5)-R^2$ | 72.63*** | 69.18*** | 259.47*** | 453.41*** | 87.47*** |
| $ARCH(5)$ | 16.40*** | 52.19*** | 156.29*** | 190.93*** | 52.19*** |
| | The static correlation coefficient matrix of the yield rate sequence of the whole sample index | | | | |
| SSEC | 1.00 | 0.24 | 0.22 | 0.09 | 0.29 |
| BSE | 0.24 | 1.00 | 0.44 | 0.09 | 0.39 |
| SET | 0.22 | 0.44 | 1.00 | 0.10 | 0.45 |
| VN | 0.09 | 0.09 | 0.10 | 1.00 | 0.13 |
| MKLCT | 0.29 | 0.39 | 0.45 | 0.13 | 1.00 |

Note: *** represents that the significance is 1%, ** represents that the significance is 5%, and * represents that the significance is 10%.

From Table1, we can see that as for the mean value of each yield rate in the sample period, the average yield rate of every market is positive, of which the BSE is the largest; as for the standard deviation, SSEC enjoys the highest level, which suggests that

compared with other emerging market countries, the distribution of high risk in China's stock market is the most obvious, while MKLCT shows the smallest standard deviation with the highest yield rate. From the perspective of kurtosis and skewness, only BSE is right bias, but other markets bias left; the left bias effect of SET and MKLCT market is the most obvious, and the tail of SET and MKLCT is the thickest, which shows the characteristics of spike thick tail. In terms of JB statistics, five markets' yield rates are not subject to normal distribution at the 1% significant level. Combined with all the indicators, only VN is the closest to normal distribution. All daily logarithm yield rates of index are not with the unit root in the sample period. In addition, Q (5) statistics show that at the significance level of 5%, the yield rate sequence of VN, SET, SSEC, MKLCT are self-related, while BSE is short of such kind of characteristic. ARCH (5) statistics suggest that the P value of the ARCH effect of the five stock markets is less than 0.05, which indicates that the volatility of yield rate is equipped with condition heteroscedasticity.

Simultaneously, Table 1 gives the non- conditional correlation coefficient between the various synthetic indices. Overall, the association between the Asian emerging economies is not high; it is seen that the correlation between India or Malaysia composite index and other emerging markets is just moderate; the correlation coefficient between MKLCT and SET is the highest but it is just 0.44. And the correlation coefficient between the Chinese stock market and other countries is not high with its value between 0.2 and 0.3, and the correlation coefficient between China and Vietnam is close to 0. Vietnam's stock market and Asia Pacific emerging markets enjoys the lowest correlation coefficient with the value around 0.1. Thus it can be considered that the correlation of the Asian emerging market stock market is not high, and it has the possibility to diversify the risk of investment. But since the data of Table 1 is under static condition, the correlation coefficient is not considered as the dynamic changes of time. In fact, correlation coefficients are time variant. Therefore, if the co-movement effect between stock markets is attained by the non-conditional correlation coefficients, the results are surely arbitrary. In this paper, we used GARCH - DCC model proposed by Engle (2012) to perfectly solve this problem for it can accurately explain the dynamic relationship between the stock markets.

# 3 Results Analysis

## 3.1 DCC-GRACH Model Estimation

In Table2, the first part gives the estimated results of autoregressive model's parameters about every index yield rate；in addition to the BSE without significant regression coefficient, as for horizontal return, the rest are all lightly but significantly autoregressive. In this way, we can improve the normal characteristic of residual yield

rate. The second part of Table 2 gives us the estimated results of $\sqrt{h_{ii,t}}$ in the single variable GARCH model. Simultaneously, the third part shows the estimated results of DCC dynamic correlation coefficient model. From Table 2, we can simply get the comparison result based on the estimated data in the second and third part.

Table2. The estimated results of parameter about the index yield rate

| | SSEC（t） | BSE（t） | VN（t） | SET（t） | MKLCT（t） |
|---|---|---|---|---|---|
| | The estimated results of autoregressive model | | | | |
| Constant | 0.020* | - | 0.013** | 0.020** | 0.023* |
| AR(1) | 0.013* | - | 0.019*** | -0.038* | 0.089*** |
| AR(2) | -0.061** | - | -0.052** | 0.052** | - |
| AR(3) | 0.069*** | - | 0.101*** | - | - |
| | The estimated results of GRACH model | | | | |
| OMEGA | 0.007854***（5.81） | 0.012019***（6.79） | 0.041128***（8.72） | 0.060185***（15.93） | 0.005792***（9.43） |
| ARCH | 0.026037***（12.45） | 0.062237***（17.64） | 0.095363***（13.54） | 0.061***（12.90） | 0.077863***（18.83） |
| GARCH | 0.970101***（406.61） | 0.933875***（249.25） | 0.884725***（120.30） | 0.894341***（137.59） | 0.912428***（187.71） |
| | The estimated model of DCC model | | | | |
| SSEC | - | 0.0051***（2.05） | 0.0116***（629.93） | 0.0048**（9.19） | 0.0142***（1.49） |
| BSE | 0.9869***（441.95） | - | 0.0112（0.15） | 0.0203（-0.99） | 0.0151***（12.50） |
| VN | 0.8901***（1301.88） | 0.6803***（51.29） | - | 0.0098***（2.71） | 0.0205（0.40） |
| SET | 0.9945*（841.44） | 0.9433***（178.31） | 0.9653***（240.04） | - | 0.0098***（2.81） |
| MKLCT | 0.9422***（170.07） | 0.9509（246.91） | 0.3214***（19.12） | 0.9800***（346.92） | - |

Note: The number in parentheses is the standard deviation, and as for the estimated model of DCC model, the upper corner matrix is alpha value and the lower corner matrix is alpha value.

### 3.2 Dynamic Correlation Coefficient and Its Result Analysis

From Table3 and Figure2, we can see the conditional coefficient of each index yield rate has the following characteristics: During the whole sample period, BSE—MKLCT, BSE—SET, BSE—SSEC, BSE—VN, MKLCT—SET, MKLCT—SSEC, MKLCT—VN, SET—SSEC, SET—VN and VN—SSEC all reflect the characteristic of time dependent correlation coefficient. They not only reflect the significant time-varying characteristic of stock market, but also show the consistency of some stock markets on changes.

The dynamic correlation graph between the BSE—VN and MKLCT—VN market shows the white noise phenomenon of the fluctuation gathering, which suggests that the correlation among India, Malaysia and Vietnam is not affected by the global financial turmoil, that is the crisis does not have an contagion effect on the three stock markets. But among other stock markets, especially the BSE, SSEC, SET and SSEC, the dynamic correlation coefficient among these four markets has changed significantly, and the dynamic correlation among the countries in the world during the financial crisis period is obviously enhanced. This is lying in the fact that the four countries, including China, India, Thailand and Malaysia, are far beyond Vietnam not only in economy power but also in the open degree of stock market.

Table 3.Basic statistical description of correlation coefficient

| | mean value | maximum value | minimum value | median | standard deviation | ADF test |
|---|---|---|---|---|---|---|
| BSE-MKLCT | 0.3430 | 0.5901 | 0.1586 | 0.3419 | 0.0666 | -6.5806*** |
| BSE-VN | 0.0849 | 0.1997 | -0.0263 | 0.0850 | 0.0182 | -22.7816*** |
| BSE-SSEC | 0.2320 | 0.3854 | 0.0336 | 0.2376 | 0.0514 | -3.1014** |
| BSE-SET | 0.4160 | 0.6449 | 0.2068 | 0.4120 | 0.0653 | -7.6612*** |
| SET-SSEC | 0.2226 | 0.3719 | -0.0715 | 0.2513 | 0.0989 | -1.6013 |
| Δ SET-SSEC | -8.51E-6 | 0.0414 | -0.1242 | -4.62E-5 | 0.0059 | -52.9827*** |
| VN-SSEC | 0.1003 | 0.2542 | -0.0537 | 0.1012 | 0.0321 | -12.0953*** |
| MKLCT-SSEC | 0.2681 | 0.4684 | 0.0994 | 0.2640 | 0.0535 | -7.9172*** |
| SET-VN | 0.0613 | 0.2619 | -0.1224 | 0.0616 | 0.0503 | -6.0235*** |
| SET-MKLCT | 0.4076 | 0.6120 | 0.1968 | 0.4020 | 0.0718 | -3.2402** |
| MKLCT-VN | 0.1242 | 0.3847 | -0.0935 | 0.1241 | 0.0247 | -36.9042*** |

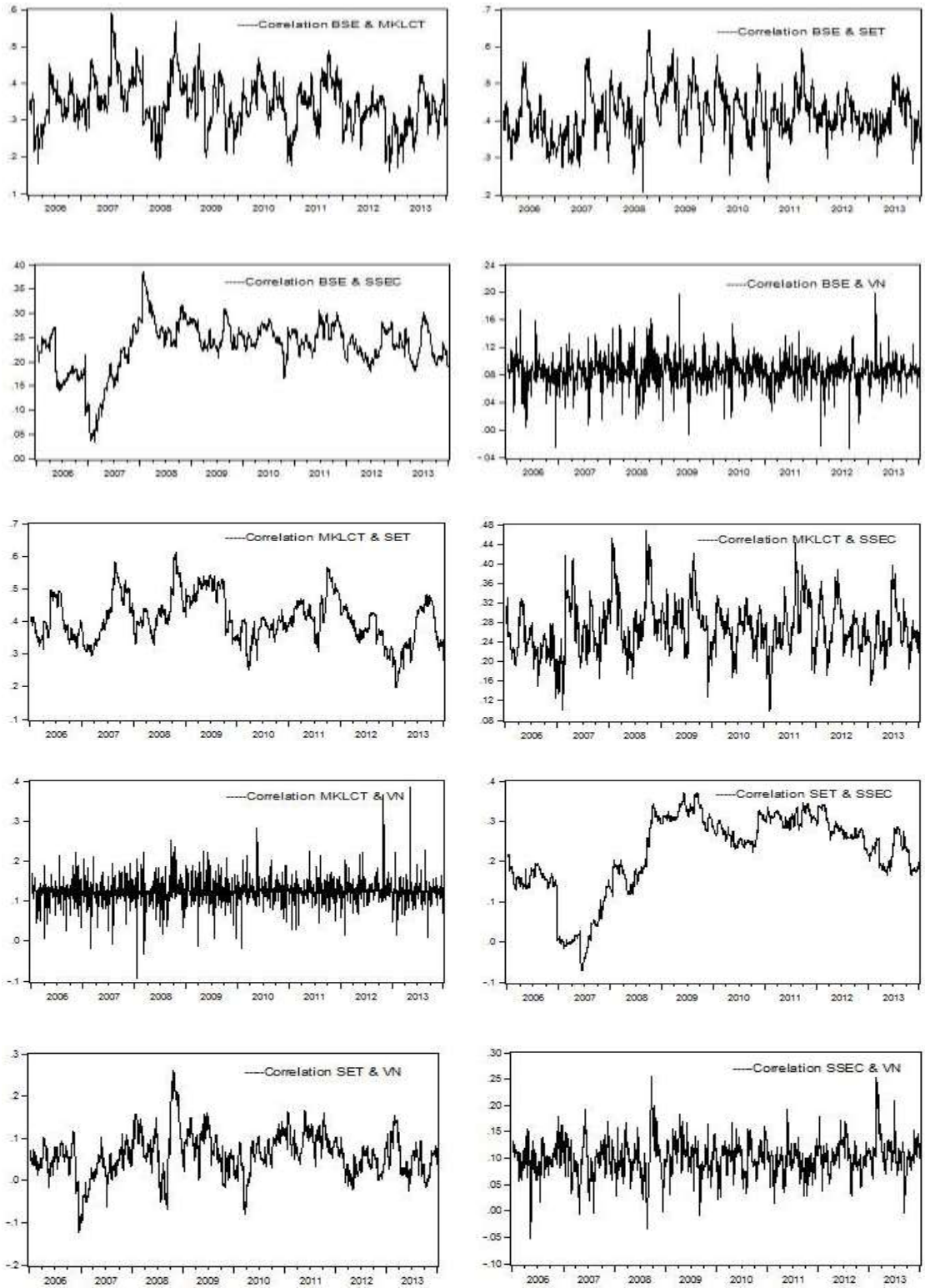


Figure 2.The dynamic correlation coefficient photos of each yield rate index

During the sample period, after the global financial crisis in 2007, the dynamic correlation between SSEC and SET or between SSEC and BSE significantly increased, which suggested that the development trends of these three markets are almost the same, and the integration degree among markets is high; while the VN index has little to do with the other four emerging markets. It may be due to the late establishment of Vietnam stock market, which brings Vietnam low degree of opening, resulting in its low co-movement with emerging markets. In addition, the correlation coefficient and standard deviation of MKLCT with emerging markets are the largest. There is a rule that the larger the average conditional correlation coefficient, the higher the degree of internationalization of the country's market, which means the country has a strong extroversion, and the degree of integration among different markets are high; simultaneously, large standard deviation illustrates its response to the outside world is more sensitive, which proves that the co-movement between the country's market and the external world is strong.

# 4 Conclusion

In this paper, we study SSEC, BSE, SET, MKLCT, VN respectively, and then construct 10 groups dynamic correlation among markets; we also use DCC-GRACH model proposed by Engle（2002） to discuss the co-movement between every two markets, and from the perspective whether the dynamic correlation coefficient occurs structural change, the paper study the contagion effect of financial crisis in markets. The results show that there are significant differences in the dynamic correlation coefficient among markets, among which the coefficient between MKLCT or SSEC and other markets is relatively large, while VN enjoys the correlation coefficient of 0 with every other country basically, which suggests that the co-movement between Vietnam stock market and other emerging economies is weak. In addition, the structural changes of conditional correlation coefficient among SET, BSE and SSEC are the most obvious, which means that the financial crisis breaking out in July 27, 2007 caused a significant contagion effect in China, India, Thailand and Malaysia. Based on the analysis above, as for investors with investment in the emerging markets in China, India, Thailand and Malaysia, it should be noted to pay attention on the conditional dynamic correlation among these four countries .and because the convergence among these markets is strong, the crisis prevention awareness should be increased when doing some investment. And the obvious market segmentation between Vietnam and other emerging economies provide possibility for diversification in different markets, so as to avoid non-system risk. Finally, with the gradual opening of the financial market, the co-movement among emerging market countries gradually enhance, which requires that financial supervisions of every country in the world take active measures to prevent the occurrence of crisis, so as to protect the healthy development of financial market. As a further extension of the research, by using

the method of principal component analysis, we select the indices of the largest contribution to the first factor as the main factors that affect the dynamic correlation coefficient (such as GDP, total import and export volume, the national direct foreign investment, etc.), and then carry out the regression analysis of them to deeply understand the reason which brings about structural changes of correlation coefficient in different stock markets, so that we can provide a more clear direction for the future of the country in policy formulation and financial risk prevention.

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