

## CHAPTER 6

### Conclusions and Future Research

#### 6.1 Summary of the Study

The influences of internationalization have become stronger in the past decade. Then, the investigation of international portfolio allocation has become necessary and plays important roles for the investors and speculators. This thesis has emphasized on the recent financial econometrics and tools with the applications of the international portfolio investment.

In the first topic, we have examined the performance of four different approaches for the problem of portfolio optimization with application of US, China and Asean market. The classical one of portfolio optimization used is the Markowitz method that the returns are assumed as normally distributed. Comparing the portfolio performance with an information theory, there are four methods in optimizing with the information theory, such as mean entropy method, mean-variance entropy method and Sharpe ratio entropy method. We set up the entropy function to be the objective function given the mean and variance in a set of linear constraints, the entropy method can also add new information into the multi-constraints. Based on the empirical results, all entropy methods were the appropriate method for portfolio optimization problem because these gave the value of a Sharpe ratio that is higher than the Markowitz method. The highest Sharpe ratio was provided by the mean-variance entropy method, which implies to the best method for portfolio optimization in this study. In addition to the information of market dependence, we used  $VaR$  model to estimate the dependence between them, then we applied the linear belief function to combine this information with the optimal weights from the results of mean-variance entropy method. We found that the results of portfolio return and variance are different before combination. In practice, the results of portfolio allocation recommended that the fund managers (or investors) should be concentrated in the Asean market.

In the second topic, the recent global financial crises in the US and Europe have an impact towards the economic system in developed countries. Alternatively, investors should find the new markets for investing and saving their fund. This study focused on the analysis of the portfolio investment in Asian emerging markets by using the new advanced financial econometrics and tools.

We have the descriptive statistics of the five stock markets in Asian emerging countries, and found that all of them are not normal distribution for the return series and standardized residuals from the GJR-GARCH model. Hence, we applied the semi-parametric method by the GPD for managing the tail of and standardized residuals and the normal kernel for controlling the centering distribution. Furthermore, we obtained the C-vine copula to determine the dependence structures of portfolio assets. The copula selected were mostly the symmetric dependency as Chinese-Indian markets, Chinese-Korean markets, Taiwanese-Thailand markets, Indian-Korean markets and Indian-Thailand markets and all markets are positive dependences. Then, AR(1)-GJR GARCH(1,1)-EVT models with C-vine copula simulate one step ahead returns for computing the  $VaR$  and  $CVaR$ . In practice, the comparison of the  $VaR$  and  $CVaR$  indicated that the Chinese market has the highest risk.  $CVaR$  optimization result supported that the fund managers (or investors) should focus on Indian and Taiwanese markets.

In the suggestion of the first study, the last topic has investigated the portfolio allocation of the Asean markets in during and post subprime crisis under the context of risk measure. We first estimate the marginal distribution with AR(1)-GJR GARCH(1,1) model. The GPD was used to capture the tail distribution and the normal kernel for interior distribution. Then, we explored the dependence analysis of these stock markets by applying the multivariate copula, C-vine copula and D-vine copula methods with  $t$  structure. Based on those copulas, we simulated one step ahead of each return markets and computed the  $VaR$  and  $CVaR$ . We found that D-vine copula can simulate the value of  $VaR$  and  $CVaR$  over than other copulas after crisis period. In order to examine the appropriate method for portfolio simulation, the  $CVaR$

optimization result found that D-vine copula can estimate the efficient frontier greater than multivariate copula and C-vine copula. Overall, D-vine copula is the suitable method for this application. Finally, the results supported the assertion that fund managers should emphasize on Thailand market for saving the risk and should focus on the Malaysian market for getting a high return after crisis period.

## 6.2 Future Research

Firstly, in the first study we applied the principle maximum entropy approach to optimize the portfolio investment. The Shannon entropy was applied into the objective function and set up as the linear constraints in the context of mean and variance. Then, the further work can improve this method by entering information into the constraints and modify the objective function by other entropy approaches.

Secondly, the second and third studies have illustrated the dependence between international stock markets with high dimensional copulas over a long period of times. Nevertheless, some events have a financial crisis, the business cycle to the stock markets. Hence, the further work can interpolate the copulas to be the regime-switching copulas for helping the above mentioned.

Lastly, this thesis used the static copulas to verify the dependence structure between the marginals and simulated the one day returns for  $VaR$  and  $CVaR$ . Further work is possible to extend the static method to become dynamic (or time-varying) copulas which may provide better results. Also, further studies should impose many scenarios on a return simulated, such as 10 days ahead, 30 days ahead, 60 days ahead or 1 year ahead.