遺傳演算法配適最佳化投資組合條件風險值及風險模型績效評估

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摘要

種類眾多的金融資產，及資訊流通的便利，讓資產的流動性提高，也使得風險提高，如何以共同標準來衡量風險已成為重要課題。風險值(Value at Risk, VaR)將風險量化成單一的數字，具有簡單易懂的優點。然而若資產的報酬分配不符合常態分配，VaR 作為投資組合最佳化的工具，可能無法正確評估風險，因此本研究以條件風險值(Conditional Value at Risk, CVaR)作為投資組合最佳化的工具，CVaR 可在報酬分配未知的情況下評估風險，且在最佳化 CVaR 的同時，即可得到最佳化 VaR 及投資組合權重。本研究採用遺傳演算法(genetic algorithm, GA)來配適最佳化 CVaR，GA 是根據達爾文的「演化論」所設計，可配適給定適應函數下的最佳結果。然而無論是何種風險模型，風險評估的正確性是相當重要的議題，國際結算銀行(BIS)要求金融機構要定期檢定風險評估方法的正確性，本研究為比較 GA 與傳統最佳化方法的差異，以三大評估準則－保守性(conservative)、準確性(accuracy)及效率性(efficiency)作為衡量風險估計績效的指標。由實證結果發現以 GA 作為風險最佳化的方法，無論是 VaR 或 CVaR，都較傳統最佳化方法來得保守，而且 CVaR 對風險的估計比 VaR 來得保守，因此 CVaR-GA 是最保守，但失敗率低，損失涵蓋度高的模型，而 Mean-VaR-NLP 最符合理論水準之要求，但較不保守，且失敗率也較高，以準確性而言，傳統最佳化方法較適當，以保守性而言則是 GA 較為適當。

關鍵字：風險值、條件風險值、遺傳演算法、投資組合、風險模型績效評估

Using Genetic Algorithm to Optimize the Conditional Value at Risk of Portfolio and Risk Models Evaluation

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Abstract

The numerous kinds of financial assets and the convenience of information circulation increase not only the liquidity of assets, but also the risk. The question of how to measure the risk using a common standard has become an important one. With the advantages of being simple and easily understood, Value-at-Risk can quantify potential losses into numbers; however, it might not evaluate risk correctly if the return of assets is not of a normal distribution. In this study, Conditional Value at Risk (CVaR) is used as a portfolio optimization tool, which can perform risk assessment even in the case of an unknown distribution of return; at the same time, using the optimal CVaR, the optimal VaR and investment portfolio weights can be obtained. In addition, a genetic algorithm (GA) is applied in this study to fit the optimal CVaR. This algorithm is designed on the basis of Darwin's "evolution theory", and can fit the best result under a given environment. However, no matter the risk model, the accuracy of risk assessment is very important. BIS specifies that financial institutions must review the accuracy of risk assessment periodically. In this study, three evaluation criteria – conservancy, accuracy and efficiency – are used as performance indicators to measure risk estimates. From the empirical results, it can be seen that GA performed VaR and CVaR optimization more conservative than traditional optimization mothod. Because CVaR is more conservative than VaR, CVaR-GA is the most conservative risk model, but its failure rate is lowest and loss coverage rate is highest. Mean-VaR-NLP is the most in line with the requirements of theory but less conservative and higher failure rate. By applying the GA to CVaR, it would be more conservative than those produced by the traditional optimization method.

Keywords: Value-at-Risk, Conditional Value-at-Risk, Genetic Algorithm, Portfolio, Risk model Performance Evaluation

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