Researches on the Portfolio Model: a Literature Review

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Keywords: Portfolio model; Behavioral finance; Market micro-structure; Liquidity; Order flow

Abstract. Since Markowitz put forward the security investment portfolio model, scholars have conducted in-depth research on the portfolio investment model, and have produced fruitful results. This paper systematically reviews the main progress of the portfolio model, including the development of portfolio based on behavior finance and market micro-structure, and point out the future development direction of the portfolio model.

Introduction

The effectiveness of the portfolio model is very important for investors. Since Markowitz put forward the theory of portfolio investment, scholars have made a deep research on the portfolio model. Based on different theories and perspectives, they put forward a variety of investment portfolio models. In this paper, we systematically review the main progress of the portfolio model, especially the related research results in the last decade, and look forward to the future development direction of the portfolio model.

Development of Portfolio Investment Model

The portfolio model was first proposed by Markowitz (1952, 1959) [1, 2]. Based on the relationship between income and risk, Markowitz (1952, 1959) [1, 2] constructs the mean-variance model, and clearly put forward the risk measurement and the philosophy of portfolio investment. This has laid a theoretical foundation for the researches of securities investment portfolio. On the basis of the mean-variance model, a variety of investment portfolio models are put forward by the scholars in different countries. Sharpe's (1964) [3] capital asset pricing model and Ross's (1976) [4] arbitrage pricing model have been known and are used by many investors. Porter et al. (1975) [5], Estrada (2007) [6], Huang (2008) [7] have studied the mean-variance model. Liu (2003) [8], Joro and Na (2006) [9], Li (2010)[10] have studied the mean-variance-skewness model. Pyle and Turnovsky (1970) [11], H.Levy and M. Levy (2009) [12], Chiu and Li (2009) [13], Hasuike and Ishii (2009) [14] et al have studied the safety-first model. Malkiel (2003) [15] have studied the negative effective investment strategy in the efficient market. He find that in the market value of stocks and small cap stocks, the market in the United States or other international markets, in the bond or stock market, passive investment strategy is an effective investment strategy. Due to the close relationship between the investment strategy and the duration of investment, the investment period will affect the investment strategy. Some scholars have studied this issue. Dierkes (2010) [16] uses the Cumulative Prospect Theory (CPT) to describe the investor preference. Based on the investor preference perspective, he analyzes the investment strategy in different investment period, and fined that bond investment strategy is more popular in the short term. While the stock investment strategy performs better in the longer term. The portfolio insurance strategy is attractive in every period of investment. In (2011) [17] studies the effect of the investment period on the strategy of growth type investment and the strategy of value investment. He uses the wavelet to analyze and decompose income investment strategy in different period under the rate. Compared these two different

combinations: combination of Fama-French and Standard & Poor combination. The results show that Fama-French combined with the investment period increases, the optimal allocation of investment investors will increase the value of the stock. Taking linear transaction costs, portfolio diversification and the degree of skewness and other targets into consideration, Zhang (2014) [18] proposes the multi-period fuzzy portfolio model, and then uses genetic algorithm, hybrid intelligent algorithm and differential approximation algorithm to solve the model.

Portfolio Model of Securities Investment Based on Behavioral Finance

With the development of behavioral finance, many scholars have studied the portfolio model from the perspective of behavioral finance. Barberis (2001) [19] studies on the capital asset pricing model based on prospect theory. He definite the utility function of investors containing consumption and wealth. So investors not only avoid the risk of consumption, but also to avoid the loss of wealth. This model can explain the equity premium puzzle. Peng and Ye (2009)[12] use the standard finance and behavioral finance as a tool for the design of investment portfolio and construct the cognitive risk and the expected return model based on the "confidence". They gain the relationship between standard finance and behavioral finance in the portfolio: only in the case of "confidence" is greater than a certain value, the income and risk have positive correlation; otherwise, it has a negative correlation. Based on the research of Shefrin and Statman, Das et al (2010) [21] propose the investment portfolio model with different multiple mental accounts. He et al. Under the cumulative prospect theory, He et al (2011) [12] put forward a large amount of loss aversion measurement, and study the influence of the large loss aversion on the portfolio model. Xu (2011) [23] introduces the emotional psychological preference into the stochastic discount factor and the risk premium, and construct the behavioral portfolio risk premium model based on emotional psychological deviation. This model can explain the equity premium and the volatility puzzle. Xu et al (2012) [24] respectively introduce the horizontal representative deviation and the vertical representative deviation into the portfolio model, study their influence on investors' portfolio decisions, and construct an optimal portfolio model based on vertical representative deviation. The empirical analysis shows that this model can get the efficient frontier of portfolio. Based on prospect theory, Liu and Jin (2015)[25] introduce the dynamic loss aversion coefficient and dynamic wealth reference point, establish the dynamic prospect theory value function, and constructs the multi-period robust portfolio model with behavior characteristics. The empirical results show that the multi-period robust portfolio model with behavior characteristics can meet the investor's psychological expectations.

Investment portfolio model based on market micro-structure

With the development of market micro-structure theory, more and more scholars have studied the model of portfolio investment from the perspective of market micro-structure. The traditional portfolio and investment strategies are constructed without taking into account the effects of micro structural variables such as liquidity, which is assumed to be free from liquidity constraints and unrestricted trading of securities. However, the liquidity of the securities has a significant impact on the return and efficiency of the security market. Long staff (2001) [26] focuses on the role of the non-liquidity of the intrinsic value of the securities on the trading strategy, and solves the problem of the cross term combination of investors limited liquidity constraints. Haliassos and Michaelides (2003) [27] discuss the optimal portfolio selection problem when investors face liquidity constraints. Vathana et al (2007) [28] have constructed an optimal portfolio selection model under the influence of liquidity risk and price. Gonzárlez and Rubio (2007) [29] study the effect of liquidity on investment portfolio and investment strategy.

Zhang and Liu (2009) [30] extend Almgren and Chriss' realizable portfolio model to construct the portfolio adjustment strategy model. This model is based on the endogenous liquidity risk. Using the example analysis, they put forward the efficient frontier of investors' adjusting of the investment strategy and find that with the increase of the investor's risk aversion coefficient, the

more inclined to the time of the transaction. Yao (2009) [31] studies the portfolio optimization problems and the impact of liquidity on portfolio management investment liquidity under the indirect effect and direct action, and builds the mean-variance-liquidity model with different portfolio liquidity. Liu et al (2011) [32] uses liquidity constraints, margin constraints and transaction costs and other factors to build long short portfolio selection model. The liquidity constraints and margin purchase are considered in this model. This model also verifies the impact of liquidity constraints, margin and transaction cost on portfolio effective frontier. Under the conditions of considering the portfolio investment income and risk influenced by market liquidity, Sui and Ma (2014) [33] put forward an investment portfolio model with fuzzy liquidity constraints. Through an example, it is proved that in the uncertain financial capital market, investors can choose their own investment portfolio according to the model, so that the limited resources can be used to the maximum extent. Chen et al (2015)[34] build a multi-objective functions model with possibility mean, possibility covariance and liquidity based on the negative correlation between stocks' liquidity and their returns. Under the investment portfolio under fuzzy environment, Fan (2016)[35] uses trapezoidal fuzzy number to describe the turnover rate of the portfolio, and establishes two objective programming model with fuzzy liquidity constraints based on net return maximization and entropy risk minimization of the portfolio.

Concluding remarks

The mean-variance model proposed by Markowitz lays a theoretical foundation for the researches of portfolio investment portfolio model. On the basis of the mean-variance model, the scholars have carried on the thorough research of the securities investment portfolio model, and have obtained the abundant research results. In this paper, we summarize the research results of investment portfolio model from the perspective of the development of portfolio model, behavior finance, market micro-structure and so on. With the development of financial market micro-structure theory, introducing the order flow and other key variables of market micro-structure into the portfolio model, and studying portfolio model from the perspective of market micro-structure, is another research direction of investment portfolio model in the future.

References

[1] H. Markowitz. Portfolio selection [J]. Journal of Finance, 1952, 7(1): 77-91.

[2] H. Markowitz. Portfolio selection: Efficient diversification of investments [M]. New York: John Wiley & Sons, 1959.

[3] W. Sharpe. Capital asset prices: A theory of market equilibrium under conditions of risk [J]. Journal of Finance, 1964, 19(91): 425-442.

[4] S. Ross. The arbitrage theory of capital asset pricing [J]. Journal of Economic Theory, 1976, 13(3): 341-360.

[5] R. B. Porter, R. P. Bey, D. C. Lewis. The development of a Mean-semivariance approach to capital budgeting [J]. Journal of Financial and Quantitative Analysis, 1975, 10(4): 639-649.

[6] J. Estrada. Mean-semivariance behavior: Downside risk and capital asset pricing [J]. International Review of Economics & Finance, 2007, 16(2): 169-185.

[7] X. X. Huang. Mean-semivariance models for fuzzy portfolio selection [J]. Journal of Computational and Applied Mathematics, 2008, 217(1): 1-8.

[8] S. Liu, S. Wang, W. Qiu. Mean-variance-skewness model for portfolio selection with transaction costs [J]. International Journal of Systems Science, 2003, 34(4): 255-266.

[9] T. Joro, P. Na. Portfolio performance evaluation in a mean-variance-skewness framework [J]. European Journal of Operational Research, 2006, 175(1): 446-461.

[10] X. Li, Z. Qin, Kar. Mean-variance-skewness model for portfolio selection with fuzzy returns [J]. European Journal of Operational Research, 2010, 202(1): 239-247.

[11] D. H. Pyle, S. J. Turnovsky. Safety-first and expected utility maximization in mean-standard deviation portfolio analysis [J]. Review of Economics & Statistics, 1970, 52(1): 75-81.

[12] H. Levy, M. Levy. The safety first expected utility model: Experimental evidence and economic implications [J]. Journal of Banking & Finance, 2009, 33(8): 1494-1506.

[13] M. C. Chiu, D. Li. Asset-liability management under the safety-first principle [J]. Journal of optimization theory and applications, 2009, 143(3): 455-478.

[14] T. Hasuike, H. Ishii. Safety first models of Portfolio selection problems considering the multi-scenario including fuzzy returns [J]. Journal of Innovative Computing, Information and Control, 2009, 5(6): 1463-1474.

[15] B. G. Malkiel. Passive investment strategies and efficient markets [J]. European Financial Management, 2003, 9(1): 1-10.

[16] M. Dierkes, C. Erner, S. Zeisberger. Investment horizon and the attractiveness of investment strategies: A behavioral approach [J]. Journal of Banking & Finance, 2010, 34(5): 1032-1046.

[17] F. In, S. Kim, R. Gencay. Investment horizon effect on asset allocation between value and growth strategies [J]. Economic Modelling, 2011, 28(4): 1489-1497.

[18] W.G. Zhang，Y.J. Liu，W.J. Xu. A new fuzzy programming approach for multi-period portfolio optimization with return demand and risk control [J]. Fuzzy Sets & Systems, 2014, 246(4): 107-126.

[19] N. Barberis, M. Huang, T. Santos. Prospect theory and asset prices [J]. Quarterly Journal of Economics, 2001, 116(1): 1-53.

[20] Y. Peng, S.Q. Ye. The Relation between Standard Finance and Behavior Finance in Portfolio[J]. Mathematics in Practice and Theory, 2009, 36(6): 51-59.

[21] S. Das, H. Markowitz, J. Scheid, et al. Portfolio optimization with mental accounts [J]. Journal of Financial and Quantitative Analysis, 2010, 45(2): 311-334.

[22] X. D. He, X. Y. Zhou. Portfolio choice under cumulative prospect theory: An analytical treatment [J]. Management Science, 2011, 57(2): 315-331.

[23] L. Y. Xu. A risk premium model of portfolio behavior based on emotional and psychological bias [J]. Statistics and Decision, 2011, (6): 138-140.

[24] X. S. Xu, Q. Song, L. L. Ma. optimal portfolio choice model and empirical analysis based on representative bias [J]. System Engineering Theory and Practice, 2012, 32(1): 34-40.

[25] J. H. Liu, X. Jin. Empirical study of multi-period robust portfolio model with behavior character [J]. System Engineering Theory and Practice, 2015, 35(6): 1405-1415.

[26] F. A. Longstaff. Optimal portfolio choice and the valuation of illiquid securities [J]. Review of Financial Studies, 2001, 14(2): 407-431.

[27] M. Haliassos, A. Michaelides. Portfolio choice and liquidity constraints [J]. International Economic Review, 2003, 44(1): 143-177.

[28] L. V. Vathana, M. Mohamed, H. Pham. A model of optimal portfolio selection under liquidity risk and price impact [J]. Finance & Stochastics, 2007, 11(1): 51-90.

[29] A. González, A. Rubio. Portfolio choice and the effects of liquidity [J]. Series Journal of the Spanish Economic Association, 2007, 2(1): 53-74.

[30] L. F. Zhang, H. L. Hai. Study on Portfolio s Readjustment Strategy Considering the Endogenous Liquidity Risk [J]. Journal of Industrial Engineering and Engineering Management, 2009, 23(3): 51-56.

[31] Y. W. Yao. Study on the management of liquidity and stock portfolio investment [J]. Shanghai: Shanghai Jiao Tong University, 2009, 61-120.

[32] H. C. Liu, J. P. Xu, M. Wu, et al. A Long-short Portfolio Selection Model with Liquidity Constraints and Margin Purchase [J]. Chinese Journal of Management Science, 2011, 19(2): 40-48.

[33] Y. Y. Sui, S. C. Ma. Portfolio selection model with liquidity constraint and its applications [J].

Statistics & Information Forum, 2014, 29(12): 24-28.

[34] N. Chen, X. Q. Li, Z. X. Wei. Fuzzy portfolio optimizaiton model with liquidity [J]. Guangxi Science, 2015, 22(2): 216-219.

[35] G. B. Fan. A portfolio model with fuzzy liquidity constraints [J]. Journal of Shandong University of Technology(Social Sciences), 2016, 32(4): 11-13.