Unit Income Risk Minimization Model and Application

Linlin Su[1,a,*]

[1] *Centre for Languages & International Education, University College London,Gower Street, London, UK*
a. dongyue0212@163.com
**corresponding author*

Keywords: portfolio investment decision model, maximizing returns, risk, risk income

Abstract: Since the establishment of the portfolio investment model with the maximization of unit risk- return, this model has been applied to many fields. This paper takes the maximum risk of unit risk as the starting point, and focuses on the core problem of the portfolio selection process—using various mathematical models to calculate, and then researching various methods for solving models and giving corresponding algorithm steps, combined with examples to test, finally show a variety of investment portfolios that can take into account both risk and return.

1. Introduction

In today's rapid development, people are increasingly pursuing high-yield but low-risk investment methods. Therefore, various mathematical models have been derived, along with decision-making problems in the case where the probability distribution of a random rate of return is unknown. The overall processing principle is to use rationality instead of probabilistic. Combine the combination investment problem with the portfolio investment selection strategy, and introduce fuzzy mathematics processing methods such as loss probability, etc., based on basic calculation method which is proposed by Yang and Tang[1]

$$\min Q = \frac{x^T \mathrm{vx}}{\mu^T x - rf}$$
$$\mathrm{st}\ e_n^T X = 1$$
$$\mathrm{x} \geq 0$$

Where rf means the percentage of risk-free investment and the unit risk-returnis the same as the unit yield risk minimum. Using matrix, normal distribution Statistical mathematics methods such as linear regression equations, by calculating the ratio of the return-to-risk ratio of portfolio investment to the advantages and disadvantages of the semi-segment combination scheme, and then optimizing the model, and finally choosing the scheme with larger ratio to represent the unit risk is also greater. This method not only compares the various methods of the same benefit or the same risk with each

other but also compares the different risks and different risks. This is also the inevitable development trend of combining various models, and it is also the reason why many models should be considered. The following articles show several more reasonable models.

2. Literature Review

In 2000, Yang and Tang[1] indicated that based on unit yield risk minimum principle, the introduction of yield parameters, but due to the combination investment securities from the securities market and stock enterprises operating performance, the influence of such factors in the process of investment, investors need to assume some risk, and then introduced variance parameters, therefore, based on the expected return and risk of the securities portfolio, calculation data of the standard deviation, correlation model is set up. However, due to the inconvenience of solving the problem of nonlinear programming, a new normal distribution model is established by introducing loss-making probability. Since the new model has an optimal solution, three kinds of free data are selected for testing, and GNO software is used to solve the problem, and the model is found to be effective.

A securities investor needs to invest in a certain security, and its return rate is r. As it is affected by the securities market and the operating performance of a joint-stock enterprise, r is a random variable. If the risk-free investment yields for rf for constant (rf), because there is no risk-free arbitrage opportunities, so when:

$$r > rf$$

investors must bear certain risks, remember the variances of the

$$r - rf\ D\ (r - rf)$$

for securities investment risk, and r - rf part referred to as the risk of market price risk (also known as risk premium or cost), which can be considered for risk compensation. We redefine the return on security as the part of it that exceeds the return on the risk-free investment: rf (i.e., excess return), i.e. R-rf. The rate of return mentioned in this paper all refers to r-rf, and r is called the actual rate of return. If investors choose n securities to invest, their yields are

$$r1\text{-}rf,r2\text{-}rf...\ Rn - rf,\ (I = 1, 2,... ,n)$$

return vector

$$r=(r1\text{-}rf,r2\text{-}rf...\ Rn\text{-}rf)T$$

expected return vector

$$E(r)=(E(r1)\text{-}rf,E(r2)\text{-}rf...\ ,$$
$$E\ (rn) - rf)\ T = (1 - rf,\ 2 - rf,...\ T,\ n - rf),$$

yields the covariance matrix of the vector

$$r\ V = (vij)\ nn,\ \text{which}\ vij = co\ (ri - rf,\ rj - rf) = cov\ (ri,\ rj),\ (I,\ j = 1,\ 2,...\ ,\ n).$$

If the proportion of investors in these n securities is

X=(x1,x2... ,xn)T, where ni=1xi=1, that is,
eTnX=1,

where en=(1,1... ,1), T is an n-dimensional column vector with allelements of 1, so the return rate of portfolio investment

R=ni=1xi(ri-rf)=ni=1xiri-ni=1xirf=ni=1xiri-rf.

Expected return rate and risk of portfolio investment are as follows:

m=E(R)=ni=1xiE(ri)-rf=ni= 1xii-rf2 =D(ni=1xiri-rf)
=D(ni=1xiri)=ni=1nj=1xixjvij=XTVX

The investor's desire is to maximize the return and minimize the risk, i.e. to make portfolio investment decisions through the following model (A). In the model (A),

maxm= tx-rfmin = xtvxx0.

Since model (A) is A multi-objective nonlinear programming problem, its solution is very inconvenient. Most decision-makers fix one objective to make the other one reach the optimal. In other words, the risk of portfolio investment is minimized when the expected rate of return is m0. Or maximize the return rate of portfolio investment under the control risk of no more than 20. In this paper, the return rate and risk are considered comprehensively to establish the portfolio investment decision model that can minimize the risk of unit return rate. Portfolio investment decision model 1.1 loss probability the so-called loss probability is that the return rate of investment is less than zero, that is, the actual return rate is less than the return rate of risk-free investment rf. The probability that the actual return is less than the return of the risk-free investment rf is called the loss probability. If R obeys normal distribution,

P{R<0}= pr-md (R)m}D(R)m2=XTVX(tx-rf)2

In particular, when R distribution is symmetric about m,

P{R<0}=P{r-mm}12D(R)m2=12XTVX(tx-rf)2

Therefore, no matter what R distribution is, to minimize the upper bound of loss probability,

XTVX(tx-rf)2

should be minimized, that is, xtvxtx-rf should be minimized. To minimize the loss probability (or the upper bound of the loss probability), a portfolio investment decision model with the minimum loss probability is established. Model (B)

$$\min Q = \frac{x^T \mathrm{vx}}{\mu^T x - rf}$$

$$\text{st } e_n^T X = 1$$
$$x \geq 0$$

model (B) comprehensively considered the return rate and risk and considered the maximum return rate and minimum risk together. The portfolio investment decision made by model (B) not only considered the maximum return rate and the minimum risk. There are three types of securities whose expected return vector and covariance matrix are respectively.

140.150.120 muon = (16%, 20%, 18%)"; V =.150 300 100 120 100 240

Let's say the return on the risk-free investment is 10%. In this case, the actual returns of the three securities are 16%, 20%, and 18% respectively; The excess and excess risk-free return rates are 6%, 10% and 8% respectively. The risk (standard deviation of return) of the three securities are respectively 140= 11.8322, 0= 300= 17.3205, 0B= 240= 15.4919. If these three securities are combined, the purpose is to minimize the return per unit of investment. From the model (B), the decision is made through the following nonlinear programming model.

minQ =Sigma = x°vx
= 100xi+ 300x + 240x. 300xx2-240x1x3 + 200xx3m
= muon 'x-ry = 0.16x1+ 0.2x2+ 0.18 x3-0.1 st
X1 + x2 + x3 = 1
2 0 x1, x22 0, x3 acuity 0

Using GNO software to solve the problem, x1= 0.5778, x2= 0.2252,x3= 0.1970, Ming = 9.01129. At this time, the return rate of portfolio securities (the part that exceeds 10% of the return rate of risk-free investment) is 7.2948%, and the risk of portfolio investment is 0.657474. Through portfolio investment, the return rate is guaranteed, which greatly reduces the investment risk.

In 2009, Ma and Li [2] stated that in view of unit hazard salary greatest standard, by the normal and the straight properties of fluffy Numbers to get the mean of the portfolio, the acquaintance of hazard estimation with guarantee the two dangers and advantages of two markers, through the grid to choose the most portfolio, accept four expected pace of return of stock for investigation choice model, it is reasoned that financial specialists ought to be completed as per the extent of speculation vector portfolio venture.

For the basic leadership issue on account of obscure likelihood circulation of irregular return rate, the general preparing guideline is to supplant likelihood with sanity. Yaniv et al. talked about the focused examination technique and portfolio venture choice system of money related to countermeasures. Chime and Cover set forward another game hypothesis technique called Log ideal speculation system. Rustem et al. proposed a hearty minimax portfolio venture technique. At present, a few researchers start to think about portfolio venture issues by utilizing a fluffy set hypothesis. Zeng Jianhua and wang shouyang proposed a portfolio speculation model dependent on fluffy programming hypothesis. Ruo-ning xu portfolio speculation choice technique dependent on fluffy data preparing research. All through the residential and outside investigation of portfolio speculation choice issue, for the advancement of a pattern is the arrival of the discerning examination. It additionally causes the presentation of fluffy arithmetic in the investigation of the preparing technique to turn into a need. The improvement of the control of 2 n the basic leadership model accepts that the distinguished hazard resources, through master discussion acquired the normal pace of return n sort of hazardous resources esteem, recall to:

~ A1, A2,... , ~ the An, ~ AiF ~ (R) (I = 1, 2,... , n),

the cut sets of is:

(~ ~ Ai iA) = [Ai (), bi ()], 0 < 1.

Set up investment n kind of risky assets ratio vector for:

w = (w1,... Wn) and w1 +... +wn=1,

then the expected return rate of the portfolio can be shown as:

=w1~1A+w2~A2+... + wn ~ the An, (1)

the average and the linear properties of fuzzy Numbers by the portfolio of averages:

g (~) = w_1g (A_1) ~ + w_2g (~ 2 a) +... + WNG (~ An), (2)

risk measure is:

the n_{D2} (~) = 121 [I = 1 wi [bi () () - ai]] 2 D, (3)

to both risks and benefits of the two indicators, assume risk, namely D ~ 0, the decision goal can be expressed as:

= (~) D (~) (g) 2, (4)
D = [dij] nn = [10: dij () = (bi - ai () () (bj () - aj ()),
g = (g ~ (A1), g (~ A2),..., g (~ nA)).

Have:

g2 (~) = wgTgwT = W_G WT,
D2 (~) = 12 WDWT, dij () d] nn, G = gTg,

and (4) can be reduced to:

= G (~) (~) 2 d = 2 WGWTWDWT (5)

apparently is positive semi-definite symmetric matrix G and d, and when the bi - ai () (), (I = 1, 2,... , n) D is positive definite linear independence. In the discussion below, assume that D is positive definite. Under the policy goals, choose the optimal portfolio decision problems can table for: Max = 2 WGWTWDWT S.T.W IT = 1. The decision model economic meaning is if investors portfolio investment according to the proportion of investment ratio vector, then the combination can raise the risk of unit yield is the largest, per unit of risk, such as portfolio can obtain the highest income. Decision model the two objective optimization problems for the single-objective optimization problem, and IT can both wind However, it is a nonlinear programming problem, which adds some complexity to the solution. +w_n=1, the necessary conditions for a solution are: w=(w_1,w_2... w_n) is the unit eigenvector of matrix d-1g.

In 2009, Gao, Chen, and Bao[3] suggested that Based on constraints of CVaR unit risk and return is the largest portfolio of principle, the constraint function model is established, and the function model of elementary particle swarm optimization, the hybrid mutation particle swarm in the two rules of unnatural genetic operator, Matlab in 1999 ~ 2003 10 are applied to solve the investment yield and relative deviation calculation, draw a unit variance biggest gains the optimal portfolio choice.

The constrained programming problem is solved by particle swarm optimization (pso) with logarithmic decreasing inertia weight and chaotic mutation strategy. Statistics and decision decision-making reference 1 model 1.1 the establishment of the objective function of the portfolio risk expression is:

$$(\alpha)^{-1}\int_{VaR}^{\infty}\frac{1}{\delta(\mathrm{x})\cdot\sqrt{2\pi}}\cdot exp\left\{\frac{[t-u(x)]^2}{2\delta^2(x)}\right\}dt = c_2(\alpha)\delta - \mathrm{E(r)}$$

Where δ is the standard deviation of all risky asset returns, E(x) is the expected return of all loans, c_1 (α)=ϕ^(-1) (α) is the standard normal distribution N(0,1) The α-lower quantile, φ is the distribution function of the standard normal N(0,1), and c_2 (α)=φ[c_1 (α)]⁄(1-α), ϕ is the probability density function of the standard normal distribution N(0,1).

Using penalty function method, the problem of constrained problem into unconstrained and then using particle swarm algorithm, here take different parameters (e.g. = 0.5). 2.1 PSO for PSO is derived from the study on the predation behavior of birds. People get enlightenment from the predation model of birds and use it to solve the optimization problem. In the PSO model, each solution of the optimization problem corresponds to a bird in the search space, called a particle. Each particle also has a velocity that determines the direction and distance it flies. PSO is initialized as a group of random particles, and the particles start to follow the current optimal particle movement until the optimal solution is found through searching the whole solution space. In each iteration, the particle updates itself by tracking two extreme values. One is the optimal solution found by the particle itself, which is called individual extreme value pb. The other is the optimal solution of the whole particle swarm, which is called the global extreme value pg. Assumptions with xi = (xi1, xi2, xi3,... Xin)T represents the ith particle, where D is the dimension of the particle, and its best position is expressed as Pi=(pi1,pi2,pi3... ,pin)T, which is also the pbest position with the best adaptive value experienced by the particle, is called the best position of the individual, while the best position experienced by the whole group is expressed as pg=(pg1,pg2... ,pgD)T, expressed as gbest. The velocity of the particle is Vi=(Vi1,Vi2... ViD). According to follow the principle of the optimal particle, particle I will press the change speed and position, namely: vti + j1 = wvitj + c1r1 (pitj - xtij) + c2r2 (pitj - xitj) ji = xitj xti + + vti + j1, t for the evolution of the current algebra, c1 and c2 for learning factor, r1, r2 as a random number between distributed in (0, 1), w as the inertia weight, studies have shown that the larger w value is conducive to jump out of local minimum point, smaller w value is advantageous to the algorithm convergence and improve the accuracy of solution, shi put forward a linear gradient Strategy,w values as follows :w= wmax-twmax-wmintmax (9)Tmax is the set maximum evolutionary algebra.

In 2004, Zhang [4]explained that in Income risk investment decisions based on the unit, set up a unit revenue risk measurement model, use Markowitz model effective set comprehensive analysis of portfolio selection, using two kinds of measurement model test data, finally it is concluded that the unit yield risk minimum combination of assets, and the results are compared with the classic standard deviation measurement, based on this gives a more reasonable investment decision:

The portfolio difference hypothesis caused an insurgency in the field of monetary speculation, based on a wide range of hypotheses, application and the examination techniques for extending continually developing. Using the Markowitz mean-variance method and related theory, we can get a set of effective portfolio and relative to a rational investor of a bunch of variance indifference curve, and under certain conditions there is a necessary indifference curve is tangent with effective set, can be determined by the tangent point of the combination is to make the investors to obtain the optimal combination of the maximum utility. The so-called effective set, also known as a portfolio of "efficient frontier" Refers to all effective portfolio "variance" (hereinafter referred to as) for effective combination of all, the effective combination refers to the variance to determine the level has the maximum expected return, at the same time, to determine the expected yield has the minimum variance portfolio. According to the assumption of Markowitz, rational investors in the financial markets is risk aversion and preference earnings, its utility function for all utility function. When the mean square utility function is equal to a constant, corresponding ground on the variance of coordinate plane can draw a curve, that is the indifference curve, the shape of the indifference curve can reflect investor risk aversion. Can be seen from the above discussed, the determination of the rational investor's optimal portfolio depends entirely on portfolio effective set and the investor's indifference curve. Unfortunately, the effectiveness of the investors in the real market or indifference curve is not as accurate as theoretical assumptions. To meet the Markowitz theory assumes that the rational, the first is that investors can risks and benefits of different portfolios on the market have a correct comparison, understanding, and judgment. However, in this respect, investors not only failed to gain much from the classical Markowitz mean-variance theory, on the other hand, is likely to produce some fuzzy understanding and even misunderstandings. Markowitz variance theory and its related result essentially is made of pure returns or risk in absolute indicators to measure and determine the different investment portfolio selection problem, but it can't for the different income and risk of portfolio integrity evaluation. For example, consider A portfolio A, B and C, their yields 2 R and variance distribution are shown in table 1. Table 1 return and variance Tab. 1 return rate and variance investment expected return R variance 2 a0. 2 00.0049 B0.300.0081 C0.400.0225 below according to Markowitz's mean-variance method, with simple portfolio return and risk to the choice of A, B and C. Easy to see from the table 1, if the expected rate of return to investment choice as A standard, is according to the characteristics of rational investor appetite returns, investors should choose in the following order: first C, B, A, again we shorthand for CBA. If the variance is a measure of risk and investment choice, rational investors choose the order shall be the ABC, because rational investors are risk-averse. Obviously, through the above analysis, we get the opposite conclusion. In the face of this situation, investors tend to feel disoriented, or even possible to measure the absolute rationality and scientific nature. In fact, according to the above absolute metrics for investment decision-making is the lack of rationality. This is because portfolio selection is closely related to risk and income, and there is a positive correlation between the benefits and risks. Therefore, when only to earnings As an indicator of investment selection, risk factors are not taken into consideration, which may lead to excessive risk-taking. Excessive risk-taking will lead to a discount rate higher than the actual return rate of investment, which will damage the actual value of the investment. But only for risk index, and without taking into account the size of the expected return, so will likely lead to overly conservative investment decisions, so that the investors lost a large number of profitable investment opportunities. To evaluate the investment performance, some scholars put forward several relative index measurement of risk methods, variation coefficient method is one of them. The coefficient of variation (V) as follows: with R = V/R to measure the yield of the portfolio, the portfolio standard deviation.

In 2009, Quan Gao and Xue [5]discussed that in light of hereditary calculation, a nonlinear whole number programming model of the portfolio with the most extreme hazard return per unit is built up by going out on a limb estimation of the portfolio as the denominator. Utilizing the count technique for VaR, utilizing multi-point hybrid administrator and transformation administrator, locate the model of the ideal arrangement, the presentation of an example of the protections showcase in China, considering the base volume and exchange costs, and so as to spread hazard, think about the greatest speculation roof, demonstrated that the model is sensible and the calculation is compelling.

Portfolio speculation of protections is to boost the arrival under certain hazards or limit the hazard under certain hazards and has a component to lessen the danger of protections venture exercises, which is the mean-difference examination technique. Notwithstanding, this model overlooks some significant factors in venture practice, for example, the suspicion that the quantity of protections is endlessly distinct in the model, and the presumption that solitary frictionless markets are considered rather than exchange costs. Least exchanging volume is a significant factor to consider in a portfolio. In China's Shanghai and Shenzhen stock trades, the base measure of offers purchased is 100. Exchange costs are another factor that should be considered. To accomplish the normal return of security, exchange costs must be considered in a particular venture portfolio. Simultaneously, to differentiate the portfolio, it is normal practice in the present stock trade to set a most extreme venture limit (typically a level of the all-out speculation) for every security. To make the Markowitz model better portray the particular act of protection portfolio, it is important to include these pragmatic elements into the model and make sensible rectification and advancement of the model. What's more, this paper means to improve the hazard estimation technique for the customary model and utilize all the more generally utilized instruments to gauge the danger of the speculation portfolio. Writing examines the particular job and utilization of budgetary supervision, and writing thinks about the portfolio issue under requirement, which mirrors the limitation impact on chance in the portfolio. Simultaneously, it is likewise imperative to plan a viable calculation for fathoming the improved new model to give direction and help to portfolio choices. Markowitz model is a number programming model with solid limitations, and it is an np-complete issue when just the base exchanging volume limit is considered in the model and no exchange costs are considered. The customary strategy to take care of this sort of issue requires a great deal of calculation and the outcome isn't perfect. For instance, writing examines the portfolio issue with the least exchanging volume limitation. Be that as it may, the ideal arrangement acquired by its calculation is commonly not a whole number, yet the arrangement nearest to fulfilling the base exchanging volume. At the point when the base exchanging volume is generally huge, the last arrangement acquired is regularly incapable to fulfill all limitations. In ongoing decades, genetic algorithms (GA) have grown extraordinarily and been broadly utilized. Given Darwin's hypothesis of advancement, hereditary calculation reenacts the procedure of organic development in nature. Contrasted and customary enhancement techniques, the hereditary calculation has solid power and high proficiency and can acquire the worldwide ideal arrangement with high likelihood. Hereditary calculations have been utilized to take care of portfolio enhancement issues. In this paper, we present an improved portfolio model with the most extreme unit hazard come back with the least exchange volume, exchange cost, and greatest venture top, and plan a hereditary calculation to fathom the model. Incentive in danger is characterized as: inside a specific holding period P and at a specific certainty level, the most extreme conceivable loss of portfolio P is communicated by the scientific equation: Prob(P >-var)= 1-var. As such, the likelihood that the portfolio esteem doesn't surpass VaR is. From the undertone of the idea, it very well may be seen that the estimation concentrating on the negative side of benefit execution returns is more by the mental sentiments of financial specialists towards dangers contrasted and the techniques for difference and standard deviation. Distinctive certainty levels reflect diverse chance inclination levels of speculators.

The bigger the worth, the more daring speculators are. Then again, financial specialists are more hazard loath. Given the above definition, three angles should be known to compute the VaR esteem. Second, the length of holding period t; Third, the conveyance qualities of benefit gathering and esteem or pace of return. Conventional techniques for VaR computation incorporate chronicled reproduction strategy, parametric strategy, and monte Carlo reenactment technique. Verifiable reenactment technique is basic, straightforward and simple to be comprehended and applied, however, it legitimately depends on chronicled information. Accordingly, when the chose test time frame isn't delegated, the VaR esteem assessed by authentic recreation strategy can't well mirror the market hazard. In light of the above contemplations, this paper accepts that the arrival on all advantages in the portfolio complies with typical circulation and applies the covariance examination technique to compute the VaR estimation of the portfolio.

In 2016, Luo[6] stated that based on the risk-returnmodel of stock portfolio, through the analysis of the quarterly return rate of stocks in China's a-share market from 1998 to 2011, the paper constructs the portfolio with Markowitz model, and then USES the multi-objective programming method to solve the satisfactory solution of the objective problem, so as to find A feasible proportional coefficient of investment. The return and risk are re-examined, that is, the ARMA model is used to estimate the return and risk. At the same time, before the above analysis, the hypothesis testing method was used to screen the stocks, and the ideal point method was used to explore the satisfactory proportional coefficient of the portfolio problem, and the conclusion was drawn that it had certain practicability and operability.

In 2011, Xiong and Shi [7] stated that behavior risk portfolio model based on the value function, using the value function will investors this psychological losses and gains introduce risk investment decision, at the same time use the partial moment to measure portfolio risk, think that the partial moment reflected more investors concerned about whether loss rate in their ability to withstand range than of the psychological characteristics of loss probability. On this basis, the risk portfolio models of single psychological account and multi-psychological account behavior based on value function are established.

In 2008, Peng, Shi and Huang [8] suggested that behavioral portfolio model based on downside moment risk, Using the partial moment of risk measure, and put forward the LBPT behavioral portfolio model. LBT model applied in risk measure index, assuming premise and decision factors are different from BPT model, reflects investors pursuit of minimum protection and mental pursuit once dafu decisions. It also discussed the meaning and value of model parameter B, and the single mental accounts model (LBPT - SA) transformed by linear programming. Unlike BPT - SA model, investment instance shows that whether in high or low expectation level desired level LBPT - SA The effective frontier of the model is similar to that of the mean-variance model. The significant advantage of LBPT model is that it can be transformed into a linear programming model and applied to the actual portfolio.

3. Conclusions

In the investment of various portfolios, the original models have improved compared with the various models. Due to various complicated situations, investors may suffer abnormal losses in the process of investment. In order to prevent this extreme situation, these mathematical models can be used to measure the maximum risk exposure of investment and ensure investors know The biggest loss that one may suffer, so that investors can choose different investment methods according to their actual situation, control the maximum risk they bear, and achieve the maximum unit risk return, and then maximize the benefits.

References

[1] Yang, G., & Tang, X. (2000). The portfolio Decision Model Based on Minimizing Risk to Return Ratio. OPERATIONS RESEARCH AND MANA GEMENT SCIENCE, 9(1).

[2] Ma, S., & Li, Y. (2009). The Ratio of Profit to Risk is Taken as Decision Object in Portfolio Selection. Journal Of Ningxia Teachers University (Natural Science), 30(3), 75-82.

[3] Gao, Y., Chen, D., & Bao, W. (2009). The Maximum Unit Risk Return Portfolio Model Based on CVaR Constraint and Its Empirical Analysis. Journal Of Statistics And Decision, 13, 62-64.

[4] Zhang, J. (2004). Investment Decision Model and Analysis Based on Risk Per Unit of Earning Rate. Journal Of Hunan University Of Arts And Science (Natural Science Edition), 16(2), 65-70.

[5] Quan, X., Gao, Y., & Xue, H. (2009). Research on the Maximum Portfolio Model of Unit Risk Revenue Based on Genetic Algorithm. Journal Of Statistics And Decision, 17, 41-44.

[6] Luo, Y. (2006). Research on Risk-Return Model Based on Stock Portfolio. Journal Of Chinese Market, 11, 88-90.

[7] Xiong, J., & Shi, B. (2011). Research on Behavioral Venture Capital Portfolio Model Based on Value Function. Journal Of Technology Economics, 30(2), 66-70.

[8] Peng, F., Shi, B., & Huang, D. (2008). Research on behavioral portfolio theory based on Low partial moments risk. JOURNAL OF MANAGEMENT SCIENCES IN CHINA, 11(6), 97-102.