Full Length Research Paper

Applying Analytic Hierarchy Process-Technique for Order Preference by Similarity to Ideal Solution (AHP-TOPSIS) model to evaluate individual investment performance of retirement planning policy

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Owing to aged people become more and more and serious economy depression in the present society in Taiwan, how retirees will keep their past consumption level after their retirement is an important issue. The purpose of this research will appraise the performance of individual investment planning policy for retirement. Because the investment performance, risks, taxation etc must be considered in making investment policy choices, the methodology of this article will apply the analytic hierarchy process (AHP) (Satty, 1980), which is a multi-criteria decision making technique and use the technique for order preference by similarity to ideal solution (TOPSIS) to select the optimal individual retirement investment planning policy to determine the effectiveness of the proposed evaluation model. The analytic hierarchy process is to be used to establish quantitative and qualitative criteria and design a framework of an assessment method for evaluating individual investment policy performance in this research. These research results will provide some suggestions for investors retirement planning.

Key words: Analytic hierarchy process, investment policy, performance measurement, retirement planning.

INTRODUCTION

Notions of private banks had begun to flourish from Switzerland in Europe. Gradually there had been the works that individuals entrust the institutions to proceed with investments. Due to recent financial environment transformation in my country, the effects of global financial crisis, fast and uncontrollable market information flow ,the more and more freedom and internationalization of financial market, and the less profit times coming, the behaviors of managing wealth become more important. The reasons give rise to this research to investigate and assess individual investment performance. To cope with the formation of aging population society, investors must consider how to keep the past consuming ability in their retirement life in the future. Turner and Helms (1989) considered that retirement is the formal end of work and the initial stage of new life role, and the role includes the expectation of behaviors and the redefinition of self.

Baillie (1993) indicated that retirement is a essential progress in life and most people choose to retire into private life in their retirement ages or the time of being unable to work. Some people may not have enough retirement pensions in the future because of the deficient assets and income or the high expenses and liabilities at present. In addition, Duncan et al. (1984) also expressed that the insufficiency of retirement pay deposits will influence the estimation of asset accumulation after retirement and the achievable appropriate consumption level of the retirement assets. Hence, the well-arranged retirement pensions investment and sufficient retirement pay deposits are respectably important. Regarding the factors of influencing retirement planning investment policy performance, for instance, Chen and Volpe (1998) showed that manage finance should comprise general knowledge of managing money, savings, credit and debt, insurance, and investment, and Keller and Siegrist (2006) meant that the tolerance of risks, income, and the reserved attitude toward money all affect the investment behaviors.

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Furthermore, Jennings and Reichenstein (2006) and Wu et al. (2008) also mentioned that it must be provided the relative indicators' understanding of risk, individual circumstances, and macroeconomic factors for individual investment, and then we proceed with the evaluation of individual retirement planning investment policy performance. Owing to individual investment is also one of an important portion of finance. For this reason, this research would like to comprehend how investors appraise the performance of retirement planning investment policies and the concerned affairs before individual retirement planning investments to develop the critical performance indicators. The indicators can give some references to individuals before making retirement planning investment policies. Because AHP is a research tool of multi-criteria decision making and TOPSIS is to find the optimal alternative, which is closest to the ideal solution and farthest to the negative ideal solution and the AHP-TOPSIS method can provide the more informative and accurate results than the conventional AHP of location analysis, this article will build up quantitative and qualitative criteria and proceed with the individual retirement planning investment policy performance evaluation through AHP and apply TOPSIS to choose the optimal individual retirement planning investment policy. The proposed evaluation criterion provides a valuable reference for individual investors in finding the best performance of a selected individual retirement planning investment policy.

LITERATURE REVIEW

This research would like to find key criteria about developing and assessing the goals of individual retirement investment policy performance. Previous studies about individual investment policy performance measurement already have discussed some influential factors such as return on investment, risk, taxation, liquidity, individual circumstances, and macroeconomic factors. And we also have to understand the meanings of performance evaluation and retirement planning from existing relative literatures.

Performance evaluation

From Schuler (1995) and Sumanth (1985), performance evaluation means a formal and structural system which can be used to measure and affect job characteristics, behaviors and outcomes about employees and to understand the job efficiency of employees. The goals of performance evaluation are to increase the job efficiency to make employees, organizations and the society acquire benefits. In addition, performance evaluation is also a kind of tools of management and control. It can arrange the priority orders of the organization goals and create competitive behaviors.

Retirement planning

Evans et al. (1985) consider that explanation of the planning is the actual life programs after retirement. The contents of programs include economy, leisure, health, inhabitation, the work after retirement, and the age of retirement.

Investment performance

Investment performance is measured with the index that was mentioned by Sharpe in 1966. The computation of the index is that the portfolios' return ratio in some period subtracts the risk-free rate in some period, and the results of subtracting between each other divides the standard deviation in some period. It is shown as the following formula:

$$\mathrm{S}harp \quad Index \quad = \quad \frac{\mathrm{E}\left(\mathrm{R}_p\right) - R_p}{\sigma_p} \tag{1}$$

$E(R_p)$ is the return ratio of portfolios in some period; R_f is the risk-free rate in some period; σ_p is the standard deviation in some period.

Higher sharpe index indicates more excess return earned when bearing per unit total risk. Since sharpe index is measured by the standard deviation of portfolios' return ratio. And the index can be comprehended the excess return that portfolios are burdened with per unit of overall risk. For this reason, the higher Sharpe index indicates that the investment efficiency is better, but the index must be corresponded to the normal hypothesis.

Other risks

Other risks are included four types, systematic risk, interest rate risk, inflation risk, and political risk. In addition, Jennings and Reichenstein (2006) and Wu et al. (2008) presented that the risk is an important factor of individual investments. Yates (1992) interpreted that the definition of the risk is a kind of functions of loss and the possibility of the return which was wanted to be gained and below some standard. Domar and Musgrave (1944) indicated that investors use return rate to weigh the investment yield and risks. The yield was the expected value of return rate and the risks were the possibility, which real return was negative or the possibility of loss.

Systematic risk

According to Saunders (1997), systematic risk is a risk that an investment region is influenced by the whole market factors, which are like nature disasters, wars,

economic depression etc. Investors can allocate their assets in different areas to lower their market risks by worldwide investment portfolios.

Interest rate risk

Saunders (1997) stated that because the change of interest rate will affect the return of investment tools, the potential danger of interest rate variation is the interest rate risk.

Inflation risk

It is a risk that can make price considerable rises continuously and affects future return (Wu et al., 2008; Azeez and Yonezawa, 2006; Friedman, 1977).

Political risk

It is the risk that is formed not only by political and lawful causes but also by all causes about political variation. Other meaning indicates that it might be produced by the unexpected obstacle of political and social continuous variation and is not generated by a specific political event. The risk will change and affect the profit and goal of an enterprise (Kobrin et al., 1980; Fitzpatrick, 1983).

Taxation

Jennings and Reichenstein (2006) noted that the definition of taxation is the costs of realizing capital gains and the benefits of allowing unrealized capital gains to make tax deferred. Taxation should be taken into account in deciding individual investmemt policies. Owing to for many private fortune managers, a lot of portfolios must be taxable. Investors shall pay more attention on after-tax returns than pretax returns in these taxable investment accounts.

Liquidity

Jennings and Reichenstein (2006) mentioned that liquidity needs are influential on investing. Schwartz (1993) thought that the definition of liquidity is that investors can complete transactions in short period and the deal price of supply and demand is reasonable.

Bid-ask spread

Bid-ask spread is the selling price subtracts buying price. It is generally used to examine liquidity (Amihud and Mendelson, 1989).

The time of transaction

The time of placing an order to the time of completing a transaction (Amihud and Mendelson, 1989).

The amount of transaction

The amount that waited to be closed deals in different selling and buying prices (Bernstein, 1987; Schwartz1993).

Liquidity ratio

It is the moving relationship between the amount of concluding the transactions and the prices (Amihud and Mendelson, 1989).

Market elasticity

The meaning of Market elasticity is when supply and demand is imbalance in a short period, it leads price change. Market elasticity is an opposite power to let the change of the price reaches the equilibrium. In other word, the price can reflect the real value of the deal thing (Bernstein, 1987, Schwartz1993).

Individual circumstances

Jennings and Reichenstein (2006) showed that individual conditions can decide the attitudes toward investment policies. This paper found several criteria in relative literatures.

Individual income

(Directorate general of budget, accounting and statistics, executive Yuan, R.O.C., 1999 to 2000): Included of the items compensation of employees, entrepreneurial income, property income, imputed rent income, current transfer receipts, and miscellaneous receipts.

Consumption spending

The expression is the money which is paid for purchasing commodities. Consumption spending involves buying goods, but it is not necessarily related to use goods. Consumption spending is different from consumption that enjoys the services of goods (Friedman, 1957).

Individual savings

(Juster et al., 1999): Savings is the difference between

personal income and consumer expenditures. Therefore, savings can be looked as the surplus which income subtracts consumption.

Liabilities

The meaning of the term is that due to the past transactions or events, someone has the obligation to pay back with assets or other services (Wild, 2005).

Individual characteristics

Individual characteristics are the movable combination of the whole psychology and the particular style that an individual adapts to external environment (Allport, 1961).

Individual health

Health is the movable balance of psychology, physiology, and society and can develop the best individual potential energy to gain individual growth and productive living (Simmons, 1989).

Macroeconomic factors

Wu et al. (2008) pointed out that some macroeconomic factors also affected the performance of investment. So it is necessary to consider the trends of the whole external economic environment. Azeez and Yonezawa (2006) discovered that money supply and exchange rate are the factors of influencing macro-economic environment. On the other hand, Abugri (2006) also found that exchange rate, interest rate and money supply is some indicators of examining macro-economic environment.

Exchange rate

It is the price at which the currency of one country can be exchanged for the currency of another country (Azeez and Yonezawa, 2006; Abugri, 2006; Wongbangpo and Sharma, 2002; Wu et al., 2008).

Producer price index

The index is used to measure the average change of the price with the price of merchandise and services of domestic producers in a period (Azeez and Yonezawa, 2006; Abugri, 2006; Wu et al., 2008).

Consumer price index

It is a kind of assessments or indicators to weigh the price of daily commodities in a period (Azeez and Yonezawa, 2006; Wongbangpo and Sharma, 2002; Wu et al., 2008)

Money supply

The amount of money within one economy. It can be measured by many ways similarly (Azeez and Yonezawa, 2006; Abugri, 2006; Wongbangpo and Sharma, 2002; Wu et al., 2008).

Gross domestic product (GDP)

Directorate General of Budget, Accounting and Statistics, Executive Yuan, R.O.C.)**:** The term means that the output amount of all production institutions or units in one country or a fixed region and no matter producers are countrymen or foreigners.

METHODOLOGY

Analytic hierarchy process (AHP)

Analytic hierarchy process is mainly applied on establishing quantitative and qualitative criteria to solve multi-criteria decision problems. By constant applications and corrections, the theory of AHP had become more complete after 1980. AHP makes the evaluations of all deciders become a final decision by pair-wise comparisons of the alternatives (Saaty, 1990). Saaty (1994) showed that if the pair-wise comparisons matrixes through the consistency test do not fit in with the requests of consistency ratio, the matrixes shall be revised again.

Assumptions of AHP (Saaty, 1980)

There are nine assumptions when using AHP: (1) the system can be separated into many classes or components to form the hierarchy structure. (2) The elements of every hierarchy must be independent to each other. (3) The elements of each hierarchy can use some elements or all elements of the above hierarchy to evaluate. (4) It must be the ratio scale in proceeding comparisons and evaluations. (5) After proceeding with pair-wise comparisons, it can make use of positive reciprocal matrix to handle. (6) The relation of preference not only has to satisfy the transitivity, but also has to satisfy the relation of strength. (7) Because complete transitivity is not easy to exist, it will permit not to be transitive to exist and test the degree of consistency. (8) The priority degree of elements can use the weighting principle to obtain. (9) Any element appearing in the hierarchy structure is thought to be in connection with the whole assessable structure regardless of the element's priority degree.

Procedure of AHP (Saaty, 1980)

To analyze the factors of affecting problems

Problems are by way of the initial analysis, and then put the possible factors of affecting problems into problems. The meaning of the step is that define the scope of problems.

Table 1. The scale statement of AHP.

The evaluation scale	Definition	Explanation
1	Equally important	It means that the two cases are equally important.
3	Slightly more importance	It means that we prefer to some case slightly.
5	Strongly more importance	It means that we prefer to some case strongly.
7	Demonstrably more importance	It means that we prefer to some case demonstrably.
9	Absolutely more importance	It means that we prefer to some case absolutely.
2, 4, 6, 8	The medium value of the adjacent scale	The compromise values (between the above explanations)

To build up the relationship of hierarchy

Let problems be divided into four parts: the highest decision objectives, the criteria, the sub-criteria and the lowest alternatives. The four parts form a framework of hierarchy. The number of hierarchy depends on the complication of problems. Every criterion is independent to each other. The elements of every hierarchy are not suitable to surpass seven ones.

The questionnaire design and to proceed the investigation

To the individual hierarchy, the elements of every hierarchy proceed the pair-wise comparisons. If there are n criteria, it will be proceeded n (n-1)/2 pair-wise comparisons. Let the members of the decision group choose the relative scale of every pair-wise element. The evaluation scales of the pair-wise comparison contain five items basically. The five items are the same importance, slight importance, strong importance, very much importance and absolute importance. Give these values of measurement into five scales: 1, 3, 5, 7, and 9. Another four scales exit between the basic five scales and are given the values of measurement 2, 4, 6, 8. The meanings of every scale are shown in the Table 1.

Consistency test

Establish the pair-wise matrixes according to the results of the questionnaire investigation. Obtain the weight of every hierarchy elements after getting the pair-wise matrixes. The pair-wise matrix is shown as below where $1 = a_{11}, a_{22}, a_{33} \dots a_{nn}$:

$$
A = [a_{ij}] = \begin{array}{c} \\ C_1 \\ C_2 \\ \vdots \\ C_n \end{array} \overset{\begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array}}{\begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ 1/a_{12} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix}}, \tag{2}
$$

Let $W_i/W_j = a_{ij}$, we can get the same matrix which is shown as:

$$
A = [a_{ij}] = \begin{array}{c} \\ C_1 \\ C_2 \\ \vdots \\ C_n \end{array} \overset{\begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array}}{\begin{bmatrix} w_1/w_1 & w_1/w_2 & \cdots & w_1/w_n \\ w_2/w_2 & w_2/w_2 & \cdots & w_2/w_n \\ \vdots & \vdots & \ddots & \vdots \\ w_n/w_1 & w_n/w_2 & \cdots & w_n/w_n \end{bmatrix}}, \tag{3}
$$

Then use Eigen value solution of the value analysis to find the largest Eigen value (λmax). We can understand A multiply the elements weight vector (x) equal to nx, so $Ax = nx$, and $(A-nI) = 0$, the x is the Eigen value (n) of eigenvector, and if A is a matrix of consistency, we will obtain X by the following formula. (Saaty, 1990)

$$
\lambda_{\max} = \sum_{j=1}^{n} a_{ij} \frac{W_j}{W_i}, \tag{4}
$$

$$
(A - \lambda_{\max} I)X = 0, \tag{5}
$$

Sometimes pair-wise comparisons are quite difficult for decision makers; therefore, the consistency test is necessary. The consistency test is used to test when people proceeding with the pair-wise comparisons, the situation of consistency is judged for the weight between each element. The results of the judgment can be understood whether they are trusted or not after the consistency test. The following is the computational way of the consistency test (C.R.)

(1) Consistency Index(C.I.), the formula of C.I.,

C.I. = λmax-n/n-1. (6)

In the formula (2) n is the number of the hierarchy elements and λmax is the Eigen value of the pair-wise comparison matrix.

(2) Random Index(R.I.) : The value can be obtained from Table 2.

(3) Consistency Ratio(C.R.) , the formula of C.R.,

C.R.=C.I/R.I (7)

For $n = 3$ the consistency ratio should be less than 0.05, for $n = 4$ it should be less than 0.08 and for $n \geq 5$ it should be less than 0.10 to get a sufficient consistent matrix. The matrix had been amended by Saaty, (1994). If C.R. fits in the above conditions, it means that the decision maker's judgment of the deviation degree of every element weight is in the acceptable scope and has the consistency. Provided that the consistency of every pair-wise matrix is suitable for the above conditions, it will still test the consistency of the whole hierarchy. If the consistency of the whole hierarchy is not suitable for the above conditions, it shows the connections between hierarchy elements have something wrong and need to connect and amend elements again.

The choice of alternatives

Proceed to compute the weight of the whole hierarchy after the

Table 2. Random index table.

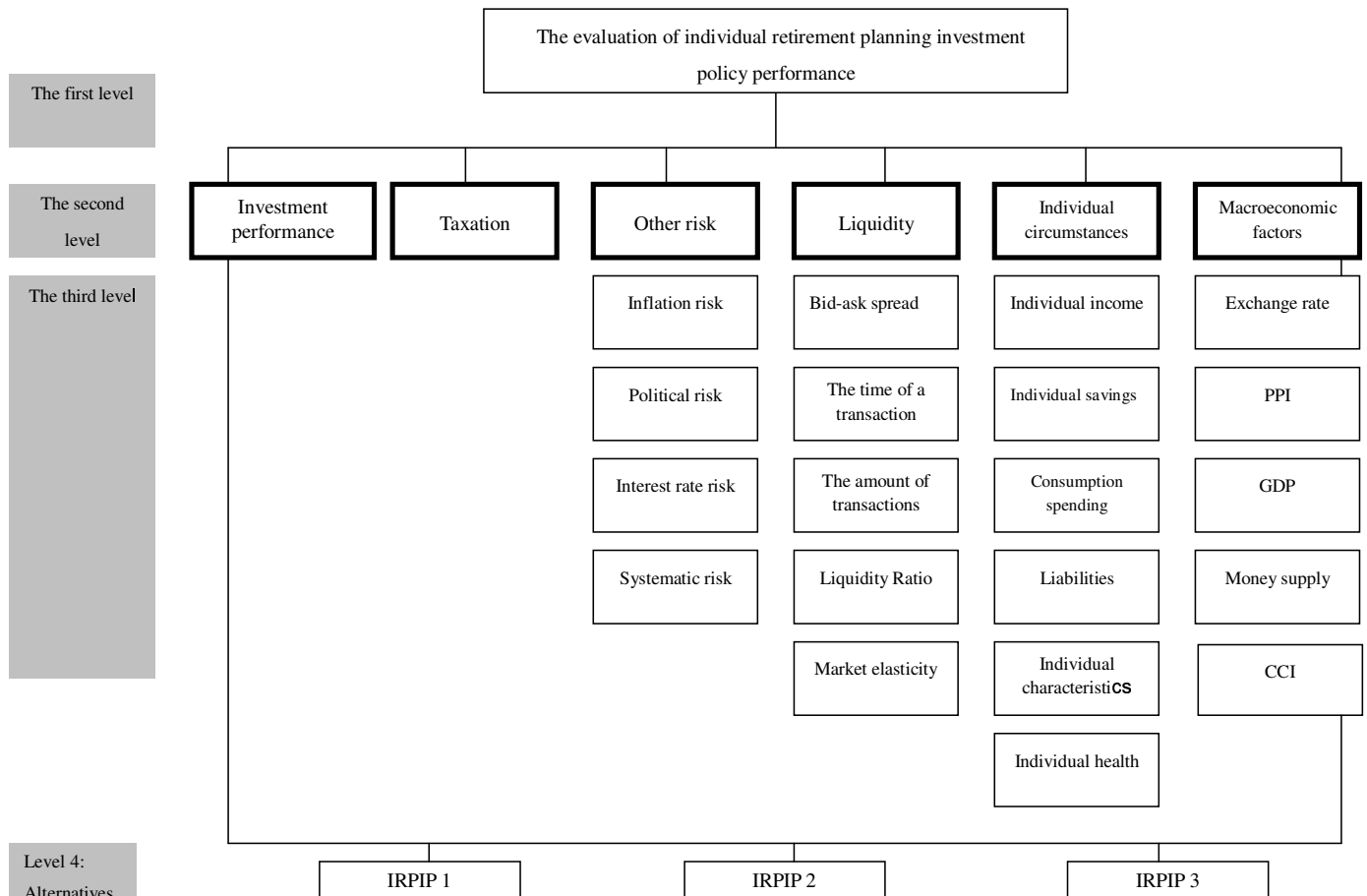| N	1	2	3	4
R.I.	0.00	0.00	0.58	0.90
N	5	6	7	8
R.I.	1.12	1.24	1.32	1.41

Figure 1. Hierarchical structure to select and evaluate the individual retirement planning investment policy performance.

computation between every hierarchy criterion. If there is only one decision maker, it will be looked for the advantage degree of alternatives. Supposing there is a group of decision makers, it will be looked for the advantage degree of every decision maker's alternatives. Finally, use the weighted average method looking for the weighted advantage degree to decide the priority orders of alternatives.

Figure 1 is the AHP structure of criteria and sub-criteria to evaluate investment policy performance for individual retirement planning. The first level is the goal to achieve. The goal is the evaluation of individual retirement planning investment policy performance. The second level is six principal criteria. The third level is sub-criteria which are included among four principal criteria. The fourth level is about alternatives. These alternatives are included three ones, individual retirement planning investment policy of mutual fund(IRPIP 1), individual retirement planning investment policy of bond(IRPIP 2), individual retirement planning investment

policy of stocks(IRPIP 3).

Technique for order preference by similarity to ideal solution (TOPSIS)

The technique is developed by Hwang and Yoon in 1981, TOPSIS attempts to define the ideal solution and the negative ideal solution. The theory assumed that there are characteristics of monotonous increasing or decreasing for every evaluation index. The ideal solution is the solution that maximizes the benefit criteria and minimizes the cost criteria; whereas the negative ideal solution maximizes the cost criteria and minimizes the benefit criteria. The optimal alternative is the one, which is closest to the ideal solution and farthest to the negative ideal solution. The ranking of alternatives in TOPSIS is based on 'the relative similarity to the ideal solution', which avoids from the situation of having same similarity

to both ideal and negative ideal solutions.

In a word, the ideal solution is composed of all best values attainable of criteria, whereas negative ideal solution is made up of all worst values attainable of criteria. During the processes of alternative selection, the best alternative would be the one that is nearest to the ideal solution and farthest from the negative ideal solution. Take the objective space of the two criteria as example, A+ and A- are, respectively, the ideal solution and negative ideal solution, and alternation A1 is shorter in distance in regard to the ideal solution (A+) and negative ideal solution (A-) than alternatives A2: As a matter of fact, the ups and downs of these two alternatives are beyond comparison, only TOPSIS has defined such "relative closeness" so as to consider and correlate, as a whole, the distance to the ideal solution and the negative ideal solution. The method is calculated as follows:

Step 1: Establishing the performance matrix

$$D = \begin{array}{c} A_1 \\ A_2 \\ \vdots \\ A_i \\ \vdots \\ A_m \end{array} \begin{bmatrix} X_{11} & X_{12} & \cdots & \cdots & X_{1j} & X_{1n} \\ X_{21} & X_{22} & \cdots & \cdots & X_{2j} & X_{2n} \\ \vdots & \vdots & \vdots & \cdots & \vdots & \vdots & \vdots \\ X_{i1} & X_{i2} & \vdots & \vdots & X_{ij} & X_{in} \\ \vdots & \vdots & \vdots & \cdots & \vdots & \vdots & \vdots \\ X_{m1} & X_{m2} & \cdots & \cdots & X_{mj} & X_{mn} \end{bmatrix},$$

(8)

where Xij is the performance of attribute Xj for alternative Ai, for i=1, 2, ..., m, j=1, 2, ..., n.

Step 2: Normalize the performance matrix
The purpose of normalizing the performance matrix is to unify the unit of matrix entries. Assume the original performance matrix is

$$X = (X_{ij}) \ \forall i, j \ ,$$

(9)

where Xij is the performance of attribute i to criterion j.
Step 3: Create the weighted normalized performance matrix
TOPSIS defines the weighted normalized performance matrix as:

$$V = (V_{ij}) \ \forall i, j \ ,$$

(10)

$$V_{ij} = w_j \times r_{ij} \quad \forall i, j \ ,$$

where wj is the weight of criterion j.

Step 4: Determine the ideal solution and negative ideal solution
The ideal solution is computed based on the following equations:

$$A^+ = \left\{ \left(\max_i v_{ij} \middle| j \in J \right) \left(\min_i v_{ij} \middle| j \in J \right) \middle| i = 1,2,...,m \right\}$$

$$= \left(v_1^+, v_2^+,...,v_j^+,...,v_n^+ \right)$$

11)

$$A^- = \left\{ \left(\min_i v_{ij} \middle| j \in J \right), \left(\max_i v_{ij} \middle| j \in J \right) \middle| i = 1,2,...,m \right\}$$

$$= \left(v_1^-, v_2^-,...,v_j^-,...,v_n^- \right)$$

(12)

where

$$j = \left\{ j = 1,2,...,n \middle| j \ belongs \ to \ benefit \ criteria \right\},$$

$$J' = \left\{ j = 1,2,...,n \middle| j \ belongs \ to \ benefit \ criteria \right\}$$

Step 5: Calculate the distance between idea solution and negative ideal solution for each alternative, using the n-dimensional Euclidean distance

$$S_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+ \right)^2} , i = 1,2,...m$$

(13)

$$S_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^- \right)^2} , i = 1,2,...,m$$

(14)

Step 6: Calculate the relative closeness to the ideal solution of each alternative

$$C_i = \frac{S_i^-}{S_i^+ + S_i^-} \qquad .i = 1,2,...m$$

(15)

where $0 \le C_i^* \le 1$. That is, an alternative i is closer to A^* as C_i^* approaches to 1. A set of alternatives can be preferentially ranked according to the descending order of C_i^*.

RESULTS

Table 1 explains what weights principal criteria are and what weights sub-criteria are. It is used to calculate the global priority. The calculating process of global priority is that each principal criterion's weight multiplies weight of each principal criterion's sub-criterion. The calculated results are shown in Table 2

Table 2 shows global priority and rank of each criterion. The result of Table 2 is that the most important criterion still is investment performance, and Gross domestic product is the last one that investors want to care about.

Table 3 interprets the weights for three investment policy under every criterion. In other words, the weights are the results of the eigenvectors for three individual retirement planning investment policies.

According to Table 1 to 3 establishing the D matrix, the weights of overall multiplied weights of Table 3 is the D matrix, than normalizing the D matrix and create the weighted normalized performance matrix using formulae (9) and (10). Table 4 summarizes those results. Determining the distance of the *i*-th alternative from the ideal and negative-ideal solutions, using formulae (11) and (12).

Table 3. Weights for three investment policy.

Criterion \ Alternative	IRPIP 1	IRPIP 2	IRPIP 3
Investment performance	0.4900	0.2020	0.3080
Taxation	0.5640	0.1720	0.2630
Systematic risk	0.5180	0.2400	0.2420
Interest rate risk	0.5003	0.2950	0.2050
Inflation risk	0.3920	0.5002	0.1078
Political risk	0.2684	0.1702	0.5614
Bid-ask spread	0.2737	0.1301	0.5963
The amount of transactions	0.2669	0.2024	0.5307
Liquidity ratio	0.4048	0.4560	0.1393
The time of a transaction	0.2488	0.1451	0.6061
Market elasticity	0.2744	0.1269	0.5987
Individual income	0.2974	0.1355	0.5670
Consumption spending	0.2794	0.1416	0.5790
Individual savings	0.3377	0.5287	0.1336
Liabilities	0.3247	0.5403	0.1350
Individual characteristics	0.2768	0.1472	0.5759
Individual health.	0.4121	0.4567	0.1312
Exchange rate	0.2721	0.4052	0.3226
Producer price index	0.3029	0.1310	0.5662
Consumer price index	0.2654	0.1772	0.5574
Money supply	0.4198	0.4536	0.1266
Gross domestic product	0.3131	0.1563	0.5307

Table 5 displays those results.

Calculate the relative closeness to the ideal solution of each alternative, C_i^*, using formula (13),(14), and (15) and determine the rank the preference order (Table 6). Thus, the optimal individual retirement planning investment policy is selected by the "individual retirement planning investment policy of mutual fund".

CONCLUSIONS AND SUGGESTIONS

Because individual retirement planning investment policy performance assessment is a problem of multi-criteria decision making, this research will be about to provide a framework of assessable individual retirement planning investment policy performance and the optimal individual retirement planning investment policy by using analytic hierarchy process and technique for order preference by similarity to ideal Solution. The essay achieves the object of performance evaluation through comprehending the priority rank of investment policy's principal criteria and sub-criteria under each principal criterion. In other words, the goal of performance evaluation is to understand what the most careful principal criterion is and what the sequence of sub-criteria under every principal criterion is when investors make retirement planning investment

decisions.

This study wants to develop an evaluation criterion to select the optimal individual retirement planning investment policy. The Synthesis Value of three individual retirement planning investment policies under six criteria are investment performance (0.413), other risk (0.213), liquidity (0.121), taxation (0.115), individual circumstances (0.099) and macroeconomic factors (0.040). Evidently, investment performance (0.413) and other risk (0.213) are high. The proposed criteria can assess the investment policy selection. The Synthesis Values of each of the three individual retirement planning investment policies, are also called the relative weights by taking some three individual retirement planning investment policies as research objects and discuss about the individual retirement planning investment policy performance evaluation, individual retirement planning investment policy of mutual fund, individual retirement planning investment policy of bond, and individual retirement planning investment policy of stocks are considered, in which the wrap enters constructs under the construction evaluation pattern. By applying AHP in obtaining criteria weight and TOPSIS in ranking. Priorities of the three individual retirement planning investment policies are individual retirement planning investment policy of mutual fund, individual retirement planning investment policy of stocks and individual retirement

Table 4. The decision making matrix.

Criterion \ Alternative	IRPIP 1	IRPIP 2	IRPIP 3
Investment performance	0.7993	0.3295	0.5024
Taxation	0.8736	0.2664	0.4073
Systematic risk	0.8354	0.3871	0.3903
Interest rate risk	0.8123	0.4790	0.3328
Inflation risk	0.6082	0.7760	0.1673
Political risk	0.4160	0.2638	0.8702
Bid-ask spread	0.4091	0.1945	0.8915
The amount of transactions	0.4253	0.3225	0.8456
Liquidity ratio	0.6472	0.7291	0.2227
The time of a transaction	0.3708	0.2162	0.9032
Market elasticity	0.4091	0.1892	0.8926
Individual income	0.4544	0.2070	0.8664
Consumption spending	0.4244	0.2151	0.8795
Individual savings	0.5265	0.8243	0.2083
Liabilities	0.5037	0.8381	0.2094
Individual characteristics	0.4221	0.2245	0.8783
Individual health.	0.6552	0.7261	0.2086
Exchange rate	0.4651	0.6926	0.5514
Producer price index	0.4622	0.1999	0.8640
Consumer price index	0.4132	0.2759	0.8678
Money supply	0.6654	0.7190	0.2007
Gross domestic product	0.4925	0.2459	0.8348

Table 5. Resultant of S_i^+ and S_i^-.

Individual retirement planning investment policy performance	S_i^+	S_i^-
IRPIP 1	$S_1^+ = 0.0345966333$	$S_1^- = 0.2147058672$
IRPIP 2	$S_2^+ = 0.218065906$	$S_2^- = 0.0273831645$
IRPIP 3	$S_3^+ = 0.1468822820$	$S_3^- = 0.0876182536$

Table 6. Summary of the TOPSIS C_i.

Individual retirement planning investment policy performance	C_i	Rank
IRPIP 1	0.861226289	1
IRPIP 2	0.111563529	3
IRPIP 3	0.373637755	2

planning investment policy of bond. For this individual retirement planning investment policy performance eva-luation in the case implementation, the three individual retirement planning investment policies considered were taken to construct under the evaluation method. The proved evaluation method can select the optimal indi-vidual retirement planning investment policy for individual investors and retirees in finding the best performance of a selected individual retirement planning investment policy.

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