

Investment Decision with Analytical Network Process Method

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Abstract

Investment is an attempt to invest capital to gain profits and avoid the risk of purchasing an asset. One investment that has considerable appeal is investment through investing in shares. Investment in shares listed on the Indonesia Stock Exchange is one of the investments with a high rate of return. The problem that arises is that not all stocks generate significant profits, because of this need, investors need an observation system screening which can support decision making with the use of modified analysis screening Piotroski and Greenblatt for portfolio investment stock with combination in several stocks growth in LQ 45 index and BUMN sectoral stocks. This study uses The Analytical Network Process method to accommodate the results of individual stock decisions. This research produces individual stock rankings that can be used as stock selection recommendations for investors.

Keywords

ANP, Greenblatt, Piotroski, Portfolio, Stocks

1. Introduction

Investment is currently growing rapidly in Indonesia, in addition to having benefits, every investment also has risks, so every investor must have sufficient knowledge about the investment to be chosen and explore information or see investment opportunities that will provide huge profits in the future (Amin and Mustikasari, 2019).

One investment that has considerable appeal is investment through investing in shares. Implementation of stock analysis can be done using an economic approach, including fundamental and technical analysis. Fundamental analysis is an analytical method based on the economic fundamentals of a company. Individual stock selection analysis conducted by investors has limitations in determining productive and profitable stocks in the future.

The lack of public information about the selection of the ideal investment leads to inappropriate and inappropriate decision making, resulting in investment losses. Measuring investment returns as expected value and quantifying investment risk as variance, under a certain variance limit of portfolio returns under a certain expected value limit (Guo, Yu, Li, & Kar, 2016)] becomes a problem for investors. As stated by the weakness of conventional methods, generally it is not easy to understand and difficult to interpret the ratio as stated by Treynor, KPMSD, 2013. Lack of information about choosing the ideal investment causes people to be less precise in choosing the right investment, causing losses.

Method Analytical Hierarchy Process (ANP) is used to analyze and select individual stocks. The ANP method can produce criteria weights and evaluate the weights of decision alternatives. The ANP method can combine qualitative analysis and quantitative analysis based on multi-criteria decisions (Ogiana, 2017). Evaluation of criteria and alternatives using the ANP method produces an individual ranking of financial ratio analysis.

The ANP approach is used because this method has a structured technique that can analyze complex decision making by determining various weighting factors and accurate evaluation factors (Megawan, 2011). One of the advantages of

the ANP method is that it can check the consistency of the comparison evaluation between criteria. According to the results of Mauko's research (2018), the criteria used in fundamental analysis involve financial ratios that have a significant influence on stock returns, the assessment of fundamental analysis begins with the distribution of stock classifications using the Lynch method, then performs calculations and weights the criteria for fundamental ratios with Piotroski and ends with a decision based on the Greenblatt screening. Therefore, performance criteria weighted subjectively using the ANP method. Stock selection is based on the results of category fundamental ratio analysis using the ANP method.

1.1 Objectives

The identification problem in investment stocks arises when involving various factors and it is not entirely relating to generate significant profits. Investment decision-making is a typical kind of multi-criteria decision-making. Investors should take many different kinds of factors into consideration to achieve the optimal decision.

Through this research are expected to achieve the goal of applying ANP to determine the priority of the interaction and restriction relationship between indices, and set up a multi-criteria decision-making indices system and decision-making for portfolio investment based on performance screening method then combine it with expert judgment from investment analyst. The benefit gained from ANP models matrix can be simplify the process investment valuation, in order to make more effectiveness and efficacy market information to transform it into investment decision making, either for single stock or as a portfolio decisions support as recommendations for investors.

2. Literature Review

Stock valuation analysis Stock valuation involves two approaches to economic analysis in the selection of company stocks, including fundamental analysis and technical analysis. The analysis in this study will be emphasized on fundamental analysis using financial ratios with the Lynch, Piotroski and Greenblatt methods. Ratio is a tool that can be used to explain the relationship between two kinds of financial data (Henrique, 2020). The ratio describes a relationship or balance (mathematical relationship) between a certain amount with another amount. Financial ratios are information that describes the relationship between various accounts (accounts) of financial statements that reflect the financial condition and results of the company's operations.

a) Lynch analysis

Lynch divides companies into several categories; (a)Fast growers, are stocks that have long-term earnings growth ($> 20\%$). (b)Stalwarts, stocks that have long-term growth between $10\% - 20\%$ per year. (c) Slow growers. Stocks that have EPS growth of less than 10% . (d) Cyclical, a company whose performance is highly dependent on economic conditions. Examples are car manufacturers, metal manufacturers, and plantations. (e)Turnarounds, a company that is in trouble but there are signs of improvement. (f)Asset Plays, A company that has a higher asset value than recorded in its books. Finding this type of company is difficult because we have to know for sure what the real value of its assets (Yangxiu, 2013)

b) Piotroski analysis

The assessment of the F-Score value is based on the value of each performance measurement indicator owned by the company, companies that meet the requirements of good financial performance based on the F-Score will get a score of 1 and companies that do not meet the requirements of good financial performance will get value 0. Based on the F-Score consists of 9 indicators of measuring the company's financial performance, which include return on assets (ROA), change in return on assets (ΔROA), cash flow from operations (CFO), accruals, change in leverage ($\Delta \text{leverage}$), change in liquidity ($\Delta \text{liquidity}$), change in equity (Δequity), change in gross margin ratio (Δmargin) and change in assets turnover ($\Delta \text{turnover}$). Companies that qualify for good financial performance based on the F-Score will get a score of 1 and companies that do not qualify for a good financial performance assessment get a score of 0. The total score of the financial performance assessment based on the F-Score range between 0 to 9 (Piotroski, 2000).

c) Greenblatt Analysis analysis

Greenblatt focused on finding good fundamental stocks by using magic formulas combined with Earnings Yield tall one. Magic Formula is a method for determining the purchase of company shares with good and cheap criteria by using return on capital and earnings yield tall one.

Return on capital (ROC) is measured by calculating the ratio of operating income before interest and taxes or earnings before interest and taxes (EBIT). Earnings yield measured by calculating the ratio of operating income before tax (EBIT) with enterprise value (EVs) This refers to the second principle of investment, buying shares at a low price (Sareewiwatthana, P., 2011)..

Combining performance results analysis with expert investment analyst judgment will be directly produce in several metric combinations with Analytic Network Process. Analytic Network Process (ANP) Method ANP is a method development Analytical Hierarchy Process (AHP). The ANP method is able to improve AHP's weaknesses in the form of the ability to accommodate linkages between criteria or alternatives. There are 2 types of linkages in the ANP method, namely linkages in a set of elements (inner dependence) and the interrelationships between different elements (outer dependence).

ANP was developed by Saaty in 1980 as an extended version of the Analytic Hierarchy Process (AHP). In 2012, Karabacak showed that the ANP algorithm consists of five main phases. (1) Problem identification and model development (2) (3) Pairwise one-to-one comparison matrix between criteria and priority vectors (4) Supermatrix (fifth) Boundary supermatrix formation

ANP shows the relationship between the element and the of the network structure. This includes a hierarchy and a hierarchy of internal cycles (Wang, 2001). ANP splits system element into two parts. The first is the control layer, which contains the goals and criteria for problem. In this section, all criteria are independent and are intended to be determined solely by the objective element. Controls can be defined without the determinant, but must contain at least one target. In this structure, all criteria are independent of each other and are determined only by the higher criteria, and the weight of for each criterion is calculated using the AHP method. The other part is the network layer, which is integrated by all elements controlled by the first layer. In this layer, elements are interdependent and dominate each other (Saaty, 1991). In ANP, each criterion governs the dependency and response network structure, but not the internal independent elements (Saaty, 2004).

The results of the Strategy Map need to be re-evaluated to determine the type of relationship with the context of the ANP method. Evaluation using the ANP method uses 3 types of relationships, namely: causal relationships, performance driving factors, and financial relationships. The Strategy Map shows an interdependence relationship for the perspective (cluster) concerned (interdependence) on the Financial perspective, the business perspective classified by the Lynch method, then the perspective of financial ratios included in the Piotroski screening and categorizing them in the value range 1 – 9. Results from the assessment range of this category

The point values and alternative weights from the evaluation of decision makers are calculated as a whole, then the normalization process is carried out and produces a group ranking of company shares. The best alternative is alternative has the highest accumulated points and weights, where each alternative has alternative points and weights, from the highest to the lowest (Green, 2010). Based on these, the research topic proposed is “Group Decision Support System in Stock Selection using the ANP Method. This research is expected to solve the problem of stock selection so as to improve performance in decision making based on analysis and observation.

Both ANP and AHP are decision-making methods. ANP is a generalization of the AHP method. ANP can use loops and feedback to model complex decision problems. On the contrary, AHP can only model simple decision problems. ANP allows feedback connections and loops, while AHP only allows hierarchical connections. Figure 1 shows the difference between AHP and ANP.

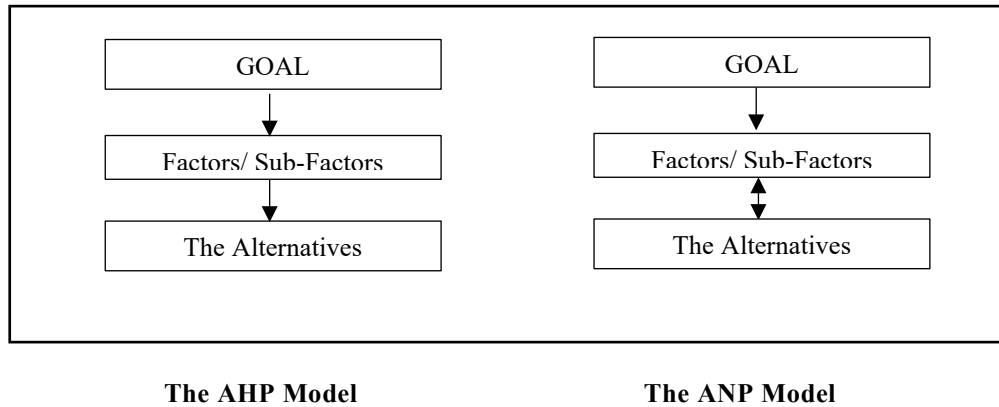


Figure 1. Difference between AHP and ANP

3. Methods

The analysis in this study will be emphasized on fundamental analysis using financial ratios with the Lynch, Piotroski and Greenblatt methods. Ratio is a tool that can be used to explain the relationship between two kinds of financial data (Henrique, 2020). Financial ratios are information that describes the relationship between various accounts (accounts) of financial statements that reflect the financial condition and results of the company's operations. The stock's performance results in these three methods screening will create an initial alternative stocks selection to use in ANP. The results of the assessment of this category range then the company's financial performance which becomes the final stage of evaluation that results in investment decision making will be done with Greenblatt screening, ending with expert judgement. Interdependence between perspectives on the Strategy Map the Initial Concept of Stock Alternative Selection can be modeled by the ANP concept in the following Figure 2,

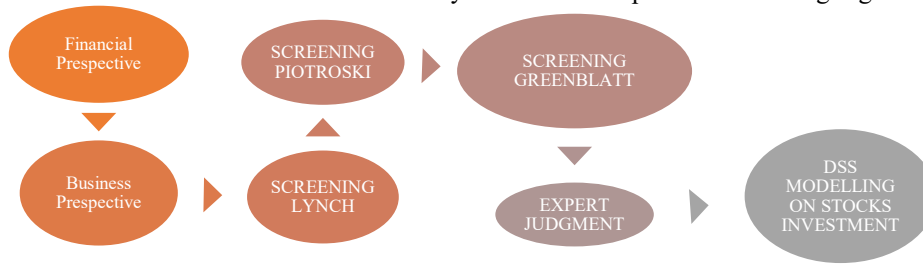


Figure 2. Strategy Map Initial Concept of Stock Alternative Selection

The Strategy Map shows an interdependence relationship for the perspective (cluster) concerned (interdependence) on the Financial perspective, the business perspective classified by the Lynch method, then the perspective of financial ratios included in the Piotroski screening and categorizing them. The best alternative is alternative has the highest accumulated points and weights, where each alternative has alternative points and weights, from the highest to the lowest (Green, 2010). Based on the exposure, the first steps taken in this study are: (1) Conducting alternative stock selections that during the period 2018 - 2020 fall into the category of screening perfoma, based on the methods of Lynch, Piotroski and Greeblatt. (2) Conducting stock selection based on criteria that according to expert investment assessors who tend to have great potential to provide returns. (3) Determining the goal of this ANP treatment, namely obtaining the potential composition of the stock portfolio that tends to provide stable positive returns, (4) Input data (1) to (3) into super decision support software that can be obtained with a web address link <https://www.superdecisions.com/>

The super matrix shows relationship between any pair of factors and sub-factors in the system. Limit matrix finds out the ranks of each alternative. Thus, the important factors and the ranking of alternatives are determined simultaneously. The ANP procedure has been represented by the flowchart in figure 3.

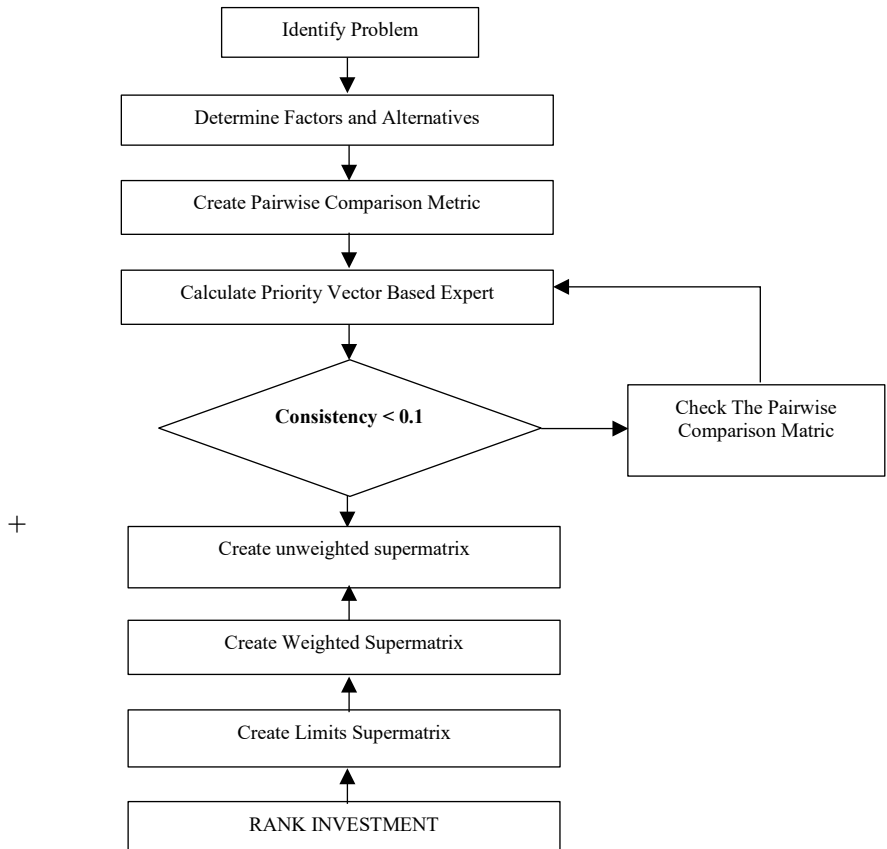


Figure 3. Steps of ANP for Investment Decision

4. Data Collection

After screening with the Lynch, Piotroski and Greenblatt methods from the performance in 2015 - 2018, 27 numbers of stock codes that became the reference for alternative shares will be included in the ANP analysis. As for the following is a list of stocks (See Table 1) that entered into an alternative to the ANP,

Table 1. Alternative Stock List from LQ 45 and BUMN at performance year 2015 -2018

| Name | Graph | Ideals | Normals | Raw |
|------|-------|---------|---------|---------|
| BBCA | | 1,00000 | 0,17303 | 0,11451 |
| BBRI | | 0,95781 | 0,16573 | 0,10968 |
| KAEF | | 0,63764 | 0,11033 | 0,07302 |
| SMGR | | 0,49864 | 0,08628 | 0,05710 |
| ANTM | | 0,33014 | 0,05713 | 0,03781 |
| ADHI | | 0,32237 | 0,05578 | 0,03692 |
| BBTN | | 0,29421 | 0,05091 | 0,03369 |
| BJBR | | 0,24497 | 0,04239 | 0,02805 |
| JSMR | | 0,23329 | 0,04037 | 0,02672 |
| ACES | | 0,19908 | 0,03445 | 0,02280 |
| BMRI | | 0,18826 | 0,03258 | 0,02156 |
| PGAS | | 0,14362 | 0,02485 | 0,01645 |
| INTP | | 0,12138 | 0,02100 | 0,01390 |
| PTPP | | 0,10322 | 0,01786 | 0,01182 |
| AAI | | 0,10103 | 0,01748 | 0,01157 |
| BTPS | | 0,09320 | 0,01613 | 0,01067 |
| ELSA | | 0,05518 | 0,00955 | 0,00632 |
| WKA | | 0,03556 | 0,00615 | 0,00407 |
| WSKT | | 0,03542 | 0,00613 | 0,00406 |
| LPPF | | 0,03234 | 0,00560 | 0,00370 |
| WTON | | 0,03168 | 0,00548 | 0,00363 |
| SMBR | | 0,02984 | 0,00516 | 0,00342 |
| INKP | | 0,02818 | 0,00488 | 0,00323 |
| ITMG | | 0,02515 | 0,00435 | 0,00288 |
| PPRE | | 0,01309 | 0,00227 | 0,00150 |
| PEHA | | 0,01224 | 0,00212 | 0,00140 |
| PTBA | | 0,01169 | 0,00202 | 0,00134 |

5. Results and Discussion

5.1 First Matrix ANP Model in Investment Decision

In the first construction of this model, produce 6 alternative combinations of stocks based on the rank of investment goals with the highest level of return on the portfolio, which can be represented as shown in Table 2 and Figure 4:

Table 2. First Matrix Stock List Rank High Return Prospect

| Name | Graph |
|------|-------------|
| BMRI | 0,114984040 |
| BBCA | 0,10220 |
| BBRI | 0,10220 |
| BJBR | 0,10220 |
| KAEF | 0,10220 |
| SMGR | 0,10220 |

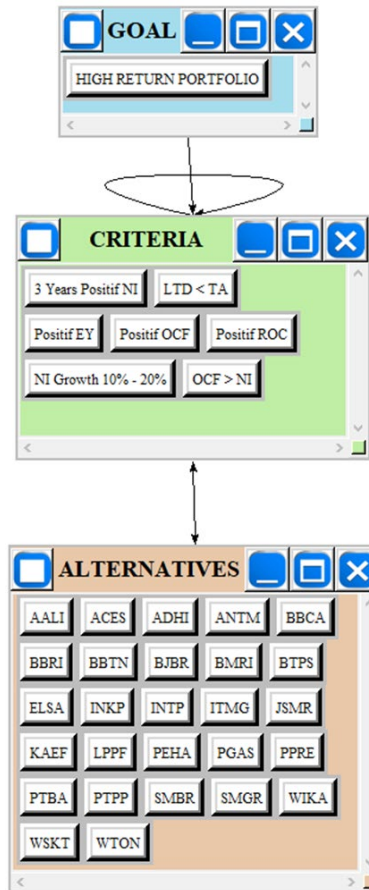


Figure 4. Construct Model 1 ANP for Investment Decision

5.2 Second Matrix ANP Model in Investment Decision

In this second matrix, the study conducted a two-way node relationship between the high return portfolio and the requirements on the assessment criteria (a) Consistency of the company's ability to generate net income over the three-year research period. (b) the total value of the company's long-term debt is less than 50% - 70% of the total wealth, as a condition to avoid financial distress in the company to be invested. (c) Have the potential for continues improvement of the company marked by a Positive Operating Cash Flow value. These three considerations are based on the results of comparisons on matrix model 1 as seen from the results of the following nodes (See Table 3 and Figure 5).

Table 3 The Results of Node Comparisons to Goal Investment with High Return Portfolio

| NODE COMPARISONS WITH RESPECT TO HIGH RETURN PORTFOLIO | | | |
|--|----------|------------|-----------|
| Inconsistency | 0.00000 | | |
| Name | Graph | Normalized | Idealized |
| Positif ROC | 0,201820 | 0,201820 | 0,100000 |
| LTD < TA | 0,1 | 0,175950 | 0,871815 |
| 3 Years Positif NI | 0 | 0,168215 | 0,833492 |
| Positif OCF | | 0,143852 | 0,712775 |
| OCF > NI | | 0,137712 | 0,682349 |
| Positif EY | | 0,113468 | 0,562223 |
| NI Growth 10% - 20% | | 0,058984 | 0,292263 |

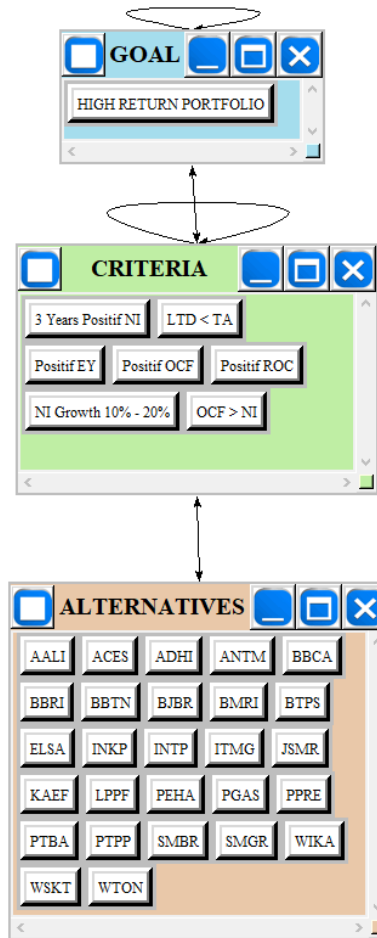


Figure 5. Construct Model 2 ANP for Investment Decision

This second matrix model produces the four best alternatives identified as providing the highest return rate on the portfolio. The alternative investment based on the selected rank value is shown in Table 4.

Table 4. Second Matrix ANP Stock List Rank High Return Prospect

| Name | Graph | Ideals | Normals | Raw |
|------|-------|---------|---------|---------|
| BBKA | | 1,00000 | 0,17303 | 0,11451 |
| BBRI | | 0,95781 | 0,16573 | 0,10968 |
| KAEF | | 0,63764 | 0,11033 | 0,07302 |
| SMGR | | 0,49864 | 0,08628 | 0,05710 |

5.3 Third Matrix ANP Model in Investment Decision

In the construction of this third model, researchers included the opinions of experts in the field of investment to make the Criteria for Growth Net Income 10% - 20% annually as part of the positive three-year net income requirement as well as operating cash flow criteria that are greater than net income results. Based on this, then on both criteria the stock selection requirement is applied as a subnet node. The result of the implementation of subnet nodes, resulting in three alternative shares that are promised to provide the highest portfolio return rate, while the rank of the three selected alternative shares is as follows (See Table 5 and Figure 6):

Table 5. Third Matrix ANP Stock List Rank High Return Prospect

| Name | Graph | Ideals | Normals | Raw |
|------|---------|---------|---------|---------|
| BBCA | 1 | 1,00000 | 0,17303 | 0,11451 |
| BBRI | 0,95781 | 0,95781 | 0,16573 | 0,10968 |
| KAEF | | 0,63764 | 0,11033 | 0,07302 |

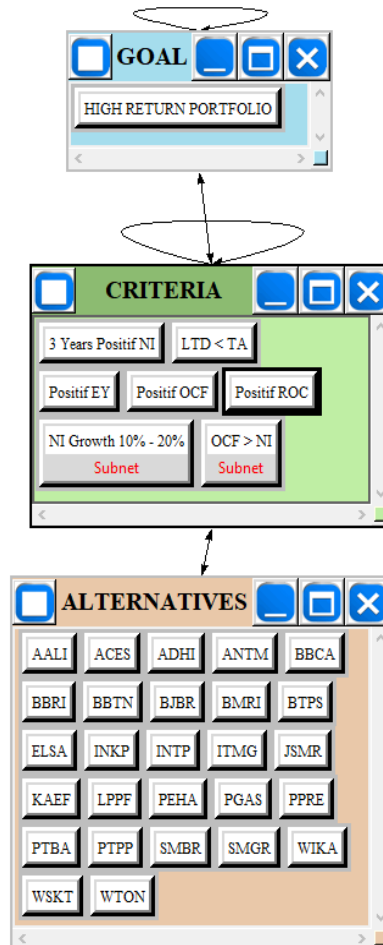


Figure 6. Construct Model 3 ANP for Investment Decision

6. Conclusion

The identification problem in investment stocks arises when involving various factors and it is not entirely relating to generate significant profits. Investment decision-making is a typical kind of multi-criteria decision-making. Investors should take many different kinds of factors into consideration to achieve the optimal decision. In this paper, we use the theory of Analytic Network Process, consider the interaction and restriction relationship between indices, and set up a multi-criteria decision-making indices system and decision-making for portfolio investment.

These studies combine screening methods of Lynch, Piotroski and Greenblatt to define the stock alternatives in market with expert investment analyst. As a result, The ANP model's matrix has strong mapping high return to be used in portfolio products either accommodate the results of individual stock decisions support as recommendations for investors.

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