

Research on the Selection Method and Investment Strategy of Growth Stock Based on Optimal Control Algorithm

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ABSTRACT. Growth-oriented investment is the best choice for medium and long-term investors, which is mainly suitable for investors with financial objectives of more than five years. Based on the principle of stock price model and optimal control algorithm, the mathematical model of stock price is established, and the fluctuation sequence of stock price is tested and analyzed, and the stock price model is analyzed and processed by optimal control algorithm. Considering the robust criteria from two aspects of data representation and method selection, a value stock selection strategy based on sequencing mechanism is established. Theoretical analysis shows that the dividend policy without dividend distribution in the growth period is in line with the maximization of stock value, and the value of growth stocks is related to the profitability, profitability sustainability (length of forecast period), capital cost and capital premium at the end of forecast period.

KEYWORDS: Optimal control algorithm, Growth stocks, Selection method, Investment strategy

1. Introduction

With the increase of residents' income, residents' demand for financial investment becomes more and more intense. With the improvement of capital market and the increase of investment channels, investors' enthusiasm for investment is increasing day by day, and the number of shareholders and listed companies is increasing rapidly. China's current stock market is an emerging market, which is in the period of development and transition. Its main characteristics are policy city, shock city, game city, national city and transitional city. As a "barometer" of economy, the stock market, while being dominated by macro-economy, also reflects and influences the development of the whole social economy to a great extent. With the rapid development of global capital market, the importance of stock investment decision-making has become increasingly prominent [1]. An effective stock investment decision can maximize the investment income under certain investment risk conditions or minimize the investment risk at a certain investment income level [2]. An effective stock investment decision can maximize investment income under certain investment risk conditions or minimize investment risk at a certain investment income level. For a long time, the academic and practical circles at home and abroad have carried out a large number of in-depth studies on this issue and achieved fruitful results.

Over the years, the topic of investment in growth stocks has attracted the attention of many investors. Despite this, few people are interested in its academic research. The obstacle of the research lies in how to make a precise and generally accepted definition of the composition of growth stocks. In an uncertain environment, the investment returns and corresponding risks are measured, which provides theoretical support for investors to make investment decisions. With the rapid development of modern science and technology, it also provides multi-faceted support for portfolio theory, modeling and numerical calculation. Based on the optimal control algorithm, this paper distinguishes the growth stocks from the stocks of other listed companies by means of expected income growth. Then, from the perspective of behavioral finance, this paper discusses the investment strategy of growth stocks, and completes a theoretical system from the selection of growth stocks to the actual investment and application.

2. Growth Investment and Growth Stock

Growth-oriented investment is the best choice for medium and long-term investors, which is mainly suitable for investors with financial objectives of more than five years. This investment style emphasizes that it is necessary to invest in companies whose sales revenue and earnings growth rate are higher than the average market level [3]. Growth stocks are stocks issued by companies that occupy a dominant position in the industry; Growth stocks are stocks that have growth potential and the stock price may rise sharply; Market efficiency hypothesis holds that excess returns cannot be obtained under available information sets (historical price information, public information and inside

information), and divides market efficiency into three forms: weak efficiency, semi-strong efficiency and strong efficiency. However, the research on stock selection strategies for obtaining excess returns has never stopped. Risk control and selling strategies include risk judgment on the overall market, such as policy risk, regulatory intervention risk, excessive transaction risk, etc., and corporate risks, such as fraud risk, violation risk, operation risk and moral hazard, etc. Such as resource characteristics, technology monopoly and high management efficiency, companies that continuously tap unused resources and may have potential in generate in the future, have sustainable development ability and can get high return on investment in the foreseeable future, or are currently in the stage of overall expansion and have achieved comprehensive growth in financial indicators and sales indicators.

In addition to paying high dividends to shareholders, growth-oriented investment companies must make proper use of their assets, reinvest their surplus in expanding their business, and strive to create long-term capital appreciation ability for shareholders. The definition of growth stock should not reflect the growth of the company represented by stock, but should reflect the growth of stock price. Of course. They are closely related, and growth companies are also the foundation of growth stocks. Generally speaking, there are two indicators: "benefit type" and "cost type" [4]. "Benefit-oriented" index refers to the index whose attribute value is bigger, the better, and the bigger its attribute value, the higher the benefit obtained; A "cost-based" indicator refers to an indicator whose attribute value is smaller, the better. The smaller the attribute value, the lower the cost. Some enterprises may have a rapid negative growth in net profit or main business income while the stock price rises. Obviously, such enterprises cannot operate for a long time, let alone their future growth. In this case, investing in such companies also loses its due value. Such stocks can't be classified as growth stocks either.

3. Principle of Optimal Control Algorithm and Analysis of Optimal Control Algorithm for Growth Stocks

3.1 Optimal Control Problem

For the selected enterprise, first of all, we believe that the industry in which the enterprise is located should have enough market scale in the future to support the growth space of the enterprise. The kind of enterprises with small market capacity, although having ultra-high short-term profits, are not considered by us. The international economic environment has many influences on enterprises, which may affect the export of companies, overseas investment income, price competition among competitors and so on. Examining the selection of value stocks from the advantage relationship of interval data can depict the good and bad relationship between individual stocks from a robust perspective, and has significant practical application value in the face of current economic reality.

The stock value is equal to the sum of the present value of dividends in each period during the duration of competitive advantage and the present value of stock selling price at the end of the period. For the sake of brevity, if the current time is set, there is [5]

$$p_0 = \sum_{i=1}^t R^{-i} d_i + R^{-T} r \quad (1)$$

The net surplus relationship expresses the definite quantitative relationship among net assets, profits and dividend distribution. The excess profit $x_t^a = x_t - ry_{t-1}$ in the t period is defined and can be obtained by combining this formula with the net surplus relationship equation

$$d_t = x_t^a + Ry_{t-1} - y_t \quad (2)$$

Substitute formula (2) into formula (1) and get it by simplification

$$p_0 = y_0 + \sum_{i=1}^T R^{-i} x_i^a + R^{-T} (p_y - y_r) \quad (3)$$

Formula (3) is the basic form of the two-stage stock valuation model.

In essence, stock selection is a sort problem, that is, according to a number of indicators, a decision-making judgment with good or bad relationship or order relationship is made for individual stocks. Dividend distribution affects the book value of net assets at the end of the period without changing profits, that is, dividend distribution does not affect profitability, but affects capital accumulation (asset growth), thus affecting the value of the company. Different control vector functions can be adopted to achieve this goal. When different control vector control systems are used, the excellence of their effects is measured by performance indicators.

3.2 Model Solving Algorithm

For listed companies, the issuance of stocks can help them to raise funds from the public faster and in a wider range, and solve the financial problems in the development process. At the same time, the company's operating and profitability are reflected in the value of stock investment. Therefore, our problem is to find an effective portfolio on the effective frontier. According to the standard multi-objective optimization theory, an effective portfolio can be obtained by solving a single-objective optimization problem. This single objective function is obtained by weighting two variables in the double objective function under convex conditions.

When the control vector is unconstrained and it is a continuous function in time, the variational method can be used to solve the necessary conditions of the optimal solution. Let the system state equation be [6]

$$x(t) = f(x, u, t), x(t_0) = x_0 \quad (4)$$

The functional of performance index is

$$J = \varphi(x(t_f), t_f) + \int_{t_0}^{t_f} L(x, u, t) dt \quad (5)$$

The end state $x(t_f)$ is constrained, and the required target set is

$$\psi(x(t_f), t_f) = 0 \quad (6)$$

For a class of functional extremum problems with equality constraints, Lagrange operator method is used to transform the constrained problems into irreducible problems.

In the specific work process, important financial links must be jointly undertaken by two or more departments and two or more employees, thus playing a good role in mutual supervision and control. In order to effectively reflect the overall characteristics of individual stock index values, "data packing" technology in symbolic data analysis method will be adopted, based on quarterly single-valued data. In addition, large companies lack mobility and flexibility, and they tend to adopt a conservative and step-by-step approach, while small companies do the opposite. This fully proves the impact of changes in the company's sustainable profitability on its value, which is consistent with the fact that earnings announcements (annual reports, mid-year reports, quarterly reports and related early warning announcements, etc.) are often accompanied by large fluctuations in the stock prices of growth stocks.

3.3 Solution of Stock Price Model Based on Control Algorithm

For stock investors, they should not only understand the major policies of the country in time and quickly, and accurately position the impact of national policies on the stocks in the sector, but also have a relatively familiar understanding of the management and operation of listed companies themselves. The cash flow of an enterprise can provide sufficient financial guarantee for the daily operation of the enterprise, and at the same time, it must have the ability to guarantee the payment of dividends to investors. Therefore, Mu Wen chooses the net cash flow of operating activities per share to reflect it.

In each portfolio, each stock in the portfolio is weighted according to the current market value, and the weighted average method is used to compile the stock price index of three stock portfolios and market portfolio. The calculation formula is [7]:

$$P_t = \frac{\sum_{i=1}^N (S_{i,t} \times X_{i,t})}{\sum_{i=1}^N X_{i,t}} \quad (6)$$

In this formula, P_t is the t -period stock price index, N is the number of stock samples in the portfolio, $S_{i,t}$ is the price of the t -period stock i , and $X_{i,t}$ is the number of shares in circulation of the t -period stock i .

When analyzing and comparing the trend of multiple indexes, because the effect of directly comparing the price indexes of different combinations is relatively poor, this paper converts the stock price index of each period into the percentage of the value of each period relative to the value of the base period, and then compares the stock price indexes of each combination after conversion. The specific conversion formula is:

$$P_t' = (P_t / P_0) \times 100 \quad (7)$$

Where P_t' is the adjusted stock price index and P_0 is the initial stock price index.

Whether the company's information disclosure is accurate and timely, whether there is a problem of investor's trust, and whether there has been an over-adjustment of accounting information for financing or other purposes; However, there are redundant explanatory variables in the process of explaining the excess returns of some large market capitalization portfolios. This shows that the value factor is a positive explanation for the excess return of the high-value portfolio, but a negative explanation for the excess return of the low-value portfolio. No company can grow forever: expansion plans have their limits. There is always a limit to the growth of the company's sales revenue and surplus: in addition, the competitive advantages such as patent rights will fail one day, and the life cycle of modern products is getting shorter and shorter.

4. Selection Method and Investment Strategy of Growth Stocks

4.1 Selection Method of Growth Stock

Because the premise of choosing growth stocks is to choose growth companies, the quality analysis of listed companies is the prerequisite of choosing growth stocks. From the existing research conclusions, the value-based investment strategy can obtain excess returns in both developed and emerging capital markets, which has been basically recognized. The rise and fall of stocks are affected by many factors, generally speaking, they are divided into two types: positive factors and negative factors. Positive factors promote stock prices to rise, while negative factors make stock prices fall. The greater the value of indicators such as the growth rate of total assets, the better the growth ability of enterprises. We call this kind of indicators positive indicators. The standardization coefficient of scale factor is generally positive, which shows that scale factor has a significant positive explanation for the combination of small market capitalization. And there are many large growth stocks that have the ability to create attractive surpluses. However, the probability that investors want to get huge returns through large-scale growth stocks is relatively low, because most of these stocks usually have already soared. From the cyclical point of view of the industry, we are more willing to invest in enterprises with market competitiveness in the growth period and maturity period. Enterprises investing in the initial stage generally have higher risks; Enterprises in the period of industry recession have gradually become slow growth enterprises or even negative growth enterprises.

Whether the growth of growth companies can continue to support the stock price increase is the most important consideration in choosing growth stocks. Enterprises with good management and intrinsic value will generally release news through formal channels, and will not cooperate with some institutions to manipulate the market, and will also issue appropriate warnings to investors on market risks. However, from the reality of investment decision-making, we know that decision-makers often expect to get a fully ordered ranking result due to the constraints of capital holding status, stock investment management ability and other conditions. At the same time, there are indicators such as current ratio, quick ratio, asset-liability ratio, etc. The closer to a certain fixed value, the better the development of enterprises. We call this kind of indicators moderate indicators.

4.2 Investment Strategy of Growth Stocks

When using the reverse investment strategy to invest, investors should pay close attention to the price trend of various stocks in the securities market, compare their prices with their basic values, find stocks whose prices far deviate from their values, and build investment portfolios, so as to gain profits when prices return to their values. In essence, the main reason is that based on the dominant relationship, the method focuses on the relative ranking position of objects, while ignoring the difference of object values; There are also significant differences in the corresponding index values at the level of corporate value characteristics, which are not comparable; However, this process does not consider the influence of the whole market on single financial data or financial portfolio data, but the actual situation is that the whole market has great influence on single financial data or financial portfolio data. According to the traditional view, growth stocks tend to be sunrise industries or emerging industries in terms of industry positioning, which may have greater development potential in the future. However, in the real world, the dividend policy of growth stocks may not be as shown in the model, which leads to the decline of stock value. Therefore, when using this model to evaluate growth stocks, we must make an in-depth analysis and adjustment of the company's dividend policy.

Ctrip.com is the largest online travel agency in China. The company has created about 82% of sales by integrating hotel reservations and air ticket transactions. The rest of Ctrip's revenue comes from travel agencies and corporate travel. More than 80% of its sales come from websites and mobile platforms, and the rest comes from call centers. The

company was founded in 1999 and listed on NASDAQ in December 2003. Figure 1 below shows the stock price chart of TCOM in recent months.

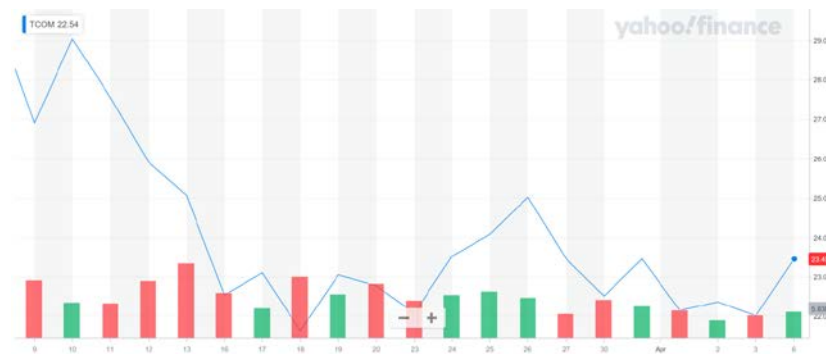


Fig.1 Tcom'S Nearly One Month Stock Price Plot

TCOM's share price has been in a cyclical growth state before the outbreak, which fluctuates greatly due to the seasonal influence. However, the epidemic and the national policy dealt a blow to TCOM, causing its share price to plummet by 8% in the first week of the outbreak. But we must understand that the market economy with Chinese characteristics will not leave any potential enterprises. Therefore, with the help of the state, the market value of TCOM has been restored to a certain extent. Therefore, with the disappearance of the epidemic in China in the first week of April and the flow of a large number of migrant workers, the market value of this book will increase predictably. Based on the above, we can predict that with the gradual end of the epidemic and the long-term government intervention in the economy. Once the epidemic is over or the government reduces taxes, the market value of TCOM will rise again.

Generally speaking. As far as business operation is concerned, the duration of a company's rapid growth stage is definitely shorter than that of its mature period and recession period. Since the classical value investment theory does not fully meet the steady investment goal, it can be predicted that the value investment theory will continue to be innovated and developed. Generally speaking, the failure to describe the difference between objects from the numerical point of view of attributes is the root of the problem of dominance method. Because these stocks are not favored by investors for a long time, the negative bubble phenomenon of prices is quite serious, and their future trend may be the return of value. This shows that for financial industries like stocks, there is a certain gap between the ideal results and the actual situation, which is also the potential risk of stocks.

5. Conclusion

Growth stocks are not equal to growth companies. If some growth companies have been fully understood by the market and their stock prices have fully reflected their future development potential, then the stocks of such companies are not growth stocks and are not worth investing in. In the era of full circulation, big shareholders have a say in the market, and no one knows the value of the company better than big shareholders. The market recognition of stock prices by big shareholders makes stock price manipulators and speculators afraid to act rashly, and prices must return to value. The mathematical model of stock price is established, and the optimal control algorithm is used to solve the mathematical model. In the process of solving, the minimum principle is used to analyze the mathematical properties of stock price fluctuation series, and the feasibility of this method for stock price fluctuation series analysis is verified by rigorous mathematical verification. Therefore, the stock selection model based on the consistent optimization of the company's operating performance and stock market performance is more robust, which may become a new research direction of stock value investment with more research significance.

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