

Retraction

Retracted: Buffett's Value Investment Theory Based on Improved DCF Model

Wireless Communications and Mobile Computing

Received 29 August 2023; Accepted 29 August 2023; Published 30 August 2023

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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- [1] J. Gai, "Buffett's Value Investment Theory Based on Improved DCF Model," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 4293248, 7 pages, 2022.

Research Article

Buffett's Value Investment Theory Based on Improved DCF Model

Junyue Gai 

King's College London, West West, Somerset House Strand, London WC2R 2LS, UK

Correspondence should be addressed to Junyue Gai; 19402077@masu.edu.cn

Received 22 June 2022; Revised 9 July 2022; Accepted 19 July 2022; Published 1 August 2022

Academic Editor: Kalidoss Rajakani

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With the development of global economy, the investment theory of capital market needs to be further developed in order to provide investors with various references in the process of value investment. Value theory is very important for international investors. Since Graham put forward the theory of value investment, he has always emphasized the importance of discounted cash flow model (DCF model) in investment evaluation. Therefore, the DCF model has great influence on investment. In order to provide some domestic investors with value-added analysis methods when investing, we will investigate the practical theory of improving the DCF model in extreme environment. Based on the theory of value investment, time series analysis is introduced to improve the DCF model. The improved DCF model can estimate the original value of an enterprise by combining the factors that affect the change of enterprise value. In the research of securities investment, considering that the existing DCF model based on the American capital market has some shortcomings in domestic capital market, it needs to be improved. To forecast the future cash flow, the time series analysis method should be used instead of the sales ratio method. American investor Warren Buffett's philosophy and practice of value investment have been paid attention to and studied by the world. Value theory is a series of famous theories put forward by Graham and applied and developed by Buffett. By combining the improved DCF model with Buffett's personal business experience, this paper analyzes and summarizes the relevant contents of Buffett's value investment theory based on the improved DCF model and puts forward some suggestions worthy of reference for Chinese investors.

1. Preface

Warren Buffett, an American investor, summed up a series of value investment philosophies with his investment experience, as well as his own wisdom and practice [1]. At each stage, he will create success and wealth through careful analysis and thoughtful operation. Even so, Buffett is not omnipotent. After all, he did not seize the opportunity of Amazon, but this mistake does not mean that Buffett's value investment is going backwards but shows that this series of value investment has wide applicability [2, 3].

The development of China's financial market is relatively short, only more than 20 years. Therefore, compared with the financial markets of other countries in Europe and America, they lack investment-related experience, so it is necessary to improve the investment theory and gradually

hone the investment spirit [4, 5]. Chinese investors are keen on speculative concept stocks, because their stock prices have soared in a short period of time, and they are likely to make huge profits soon [6]. They are keen on speculative concept stocks, so as to make quick gains. From March 1, 2022, to March 14, 2022, the performance (%) of major global concept stock indexes is shown in Figure 1.

Among Chinese investors, especially ordinary investors, the cluster effect is obvious. Due to the integration of China's capital market and international standards, the DCF model is often used as one of the methods to evaluate the original asset value of stocks [7, 8]. Benjamin Graham, who is famous as the father of value investment, believes that intrinsic value is the most important thing. While carrying forward the theory of value investment, Buffett advocates

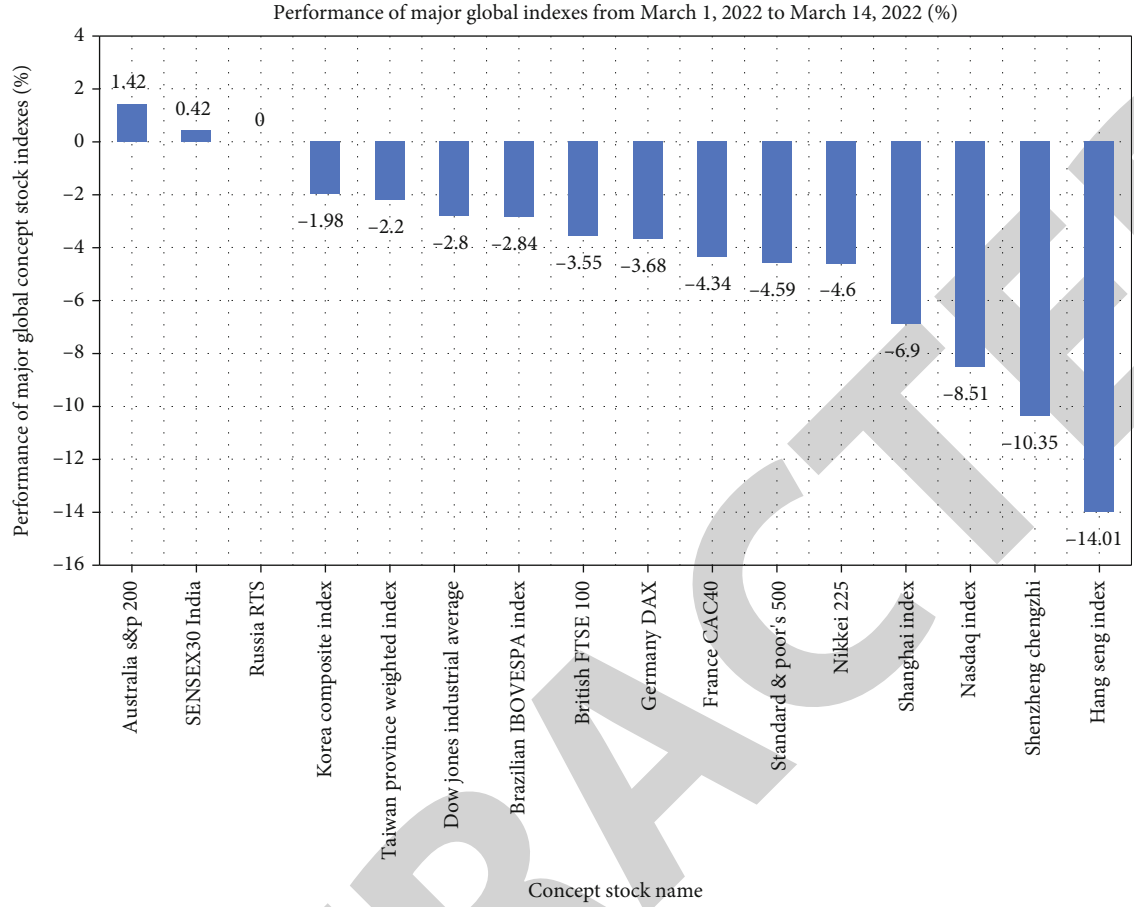


FIGURE 1: Performance (%) of global major concept stock index from March 1, 2022, to March 14, 2022.

that Williams' discounted cash flow model is a good method to evaluate the original asset value of stocks [9–11].

Buffett has also said that value investment theory knows no borders and can be used by all countries. Munger, Buffett's business partner, said Chinese is better at value investing than at speculation. Many institutional investors in China have made great achievements in the use of value investment in the financial market, and ordinary shareholders have gradually joined the ranks of value investment.

In recent years, China's stock market has experienced great ups and downs and is still at a relatively low stage, so value investors can seize the opportunity to enter. A list of global stock market quotes on April 29, 2022, is shown in Table 1.

2. Discounted Cash Flow Model (DCF Model)

2.1. Basic Model. Williams' discounted cash flow model assumes that dividends are the only cash flow that investors get, and the value of stocks or bonds is calculated according to the cash flow and discount rate generated in the future period. After long-term development and improvement, a discounted cash flow model called DCF model for short has been formed, which is widely used in the field of value

evaluation and value investment [12–14]. The basic expression is shown in

$$V = \sum_{t=1}^T \frac{FCF_t}{(1+WACC)^t} + \frac{P_T}{(1+WACC)^2}. \quad (1)$$

Among them, FCF_t is the estimated free cash flow in the t year; T is the forecast period; P_T is the enterprise value in the stable growth stage.

The expression of the final value of enterprise value in the stable growth stage is shown in

$$P_T = \frac{FCF_{T+1}}{WACC - g}. \quad (2)$$

Among them, FCF_{T+1} is the free cash flow in the first year of the stable period; g is the sustainable growth rate.

The DCF model needs to be based on a complete capital market hypothesis [15]. If the external environment is a complete capital market, the value of the assessed assets is equal to its market price. Because free cash flow may be negative, emerging or financially strapped companies cannot use this model to predict company value. When the DCF

TABLE 1: List of global stock market index on April 29, 2022.

| Name | Latest price | Highs and lows | Rise and fall | Highest | Minimum | Yesterday | Turnover time |
|--------------------------------|--------------|----------------|---------------|----------|----------|-----------|---------------|
| Shanghai Index | 3081.47 | -4.93 | -0.0018 | 3107.76 | 3050.03 | 3086.4 | 14:21:35 |
| Shenzhen Chengzhi | 9698.15 | -82.67 | -0.0089 | 9822.82 | 9597.09 | 9780.82 | 14:21:39 |
| Taiwan Province Weighted Index | 10939.06 | -13.41 | -0.0012 | 10991.93 | 10906.95 | 10952.47 | 13:54:00 |
| Singapore Straits Index | 3396.91 | 39.96 | 0.0111 | 3396.91 | 3365.05 | 3356.95 | 14:23:01 |
| South Korea Heald. | 2213.21 | 33.9 | 0.0156 | 2213.21 | 2181.82 | 2179.31 | 14:20:10 |
| Nikkei 225 | 22258.73 | -48.85 | -0.0022 | 22270.29 | 22073.1 | 22307.58 | 6:45:18 |
| Hang Seng Index | 29845.56 | 265.19 | 0.0088 | 29884.06 | 29639.38 | 29580.37 | 14:22:17 |
| Indian Index | 39067.33 | 336.47 | 0.0087 | 39103.16 | 38765.33 | 38730.86 | 6:45:18 |
| Gupo Comprehensive | 1633.34 | -5.04 | -0.0031 | 1637.49 | 1631.83 | 1638.38 | 12:44:59 |
| Thai Stock Synthesis | 1665.25 | -1.9 | -0.0011 | 1669.31 | 1663.76 | 1667.15 | 13:45:02 |
| Comprehensive Australia | 6360.4 | -25.2 | -0.0039 | 6385.6 | 6348 | 6385.6 | 14:00:06 |
| Nasdaq Index | 8146.4 | 27.72 | 0.0034 | 8146.42 | 8060.9 | 8118.68 | 5:16:02 |
| Daoqiong Industry | 26543.33 | 81.25 | 0.0031 | 26543.56 | 26392.55 | 26462.08 | 7:06:58 |
| Standard & Poor's 500 | 2939.88 | 13.71 | 0.0047 | 2939.88 | 2917.56 | 2926.17 | 7:06:58 |
| Commodity Index (CRB) | 184.66 | -1.82 | -0.0098 | 185.35 | 183.91 | 186.48 | 7:06:58 |
| English FTSE | 7428.19 | -5.94 | -0.0008 | 7442.39 | 7398.57 | 7434.13 | 23:50:30 |
| Dedax | 12315.18 | 32.58 | 0.0027 | 12323.64 | 12259.76 | 12282.6 | 23:50:28 |
| Law CAC40 | 5569.36 | 11.69 | 0.0021 | 5575.25 | 5546.82 | 5557.67 | 23:50:30 |

model calculates negative company value, it loses its economic significance [16, 17].

2.2. Free Cash Flow. In 1986, Rabaport coined the term free cash flow. This refers to the funds that stakeholders can use after the business profit meets the regeneration demand. The discounted cash flow valuation elements are shown in Figure 2.

In 1990, Professor Tom Copeland put forward the calculation method of FCF: the free cash flow equals the net operating profit after tax of the enterprise, plus the deducted depreciation and amortization items of noncash expenses, and then minus the increased working capital and investment in plant equipment and other assets to maintain normal operations [18, 19]. The calculation formula is shown in

$$\begin{aligned}
 & \text{Enterprise free cash flow} \\
 & = (\text{net operating profit after tax} \\
 & \quad + \text{depreciation and amortization}) \\
 & \quad - (\text{working capital increase} + \text{capital expenditure}).
 \end{aligned} \tag{3}$$

From free cash flow to enterprise value is shown in Figure 3.

2.3. Discount Rate. Discount rate usually uses weighted average cost of capital, and its expression is shown in

$$WACC = K_d \times \frac{B}{V} + K_s \times \frac{S}{V}. \tag{4}$$

Among them, B is the corporate debt; S is the owner's equity of the enterprise; V is the total market value of the

enterprise; K_d represents the cost of creditor's rights; K_s represents the cost of equity.

Among them, the cost of creditor's rights capital is usually determined according to the loan interest rate of more than five years announced by the central bank after tax.

Capital cost usually adopts CAPM, and the specific expression is shown in

$$R_i = R_f + \beta(R_m - R_f). \tag{5}$$

Among them, R_i is the necessary rate of return; R_f is the risk-free rate of return; β is the beta coefficient of the stock; R_m is the average risk stock return rate. Obtained from Wande database, we choose to eliminate the beta value of financial leverage $\beta R_m \beta$.

2.4. Disadvantages of the DCF Model. Determining the parameter FCF is a big difficulty in the DCF model. Professor Copeland proposed a formula to calculate FCF. Parameters are taken from the financial statements of operators that can better reflect the operation of enterprises. Fc calculation uses financial statements for management, which can be more in line with the operation of enterprises. Therefore, this paper uses this formula to calculate free cash flow. However, there are two items of data in the calculation formula that cannot be directly extracted from the financial statements. Among them, depreciation items and amortization items only refer to the depreciation amount incurred in the current period.

The DCF model assumes that the ratio of each item in the financial statements to the operating profit is fixed. It uses the sales ratio method to predict the future free cash flow, estimate the company's future growth rate, and determine the sales through the forecast. A certain percentage

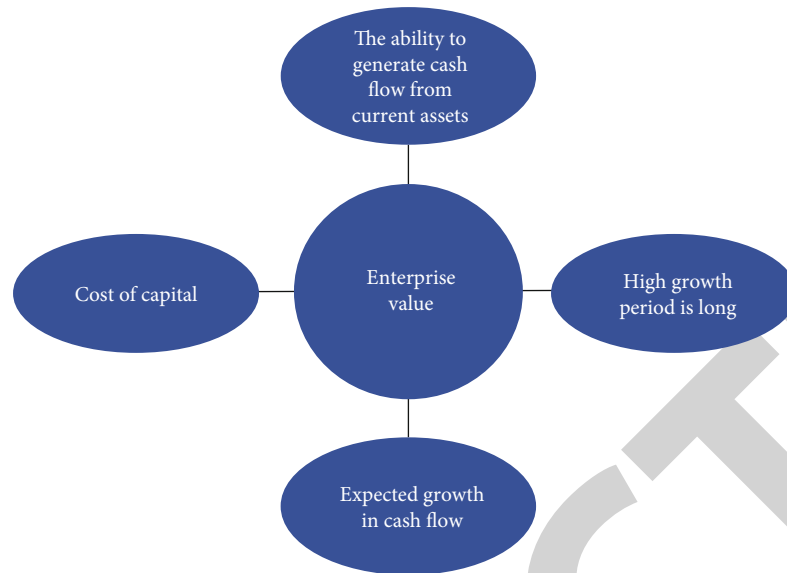


FIGURE 2: Discounted cash flow valuation elements.

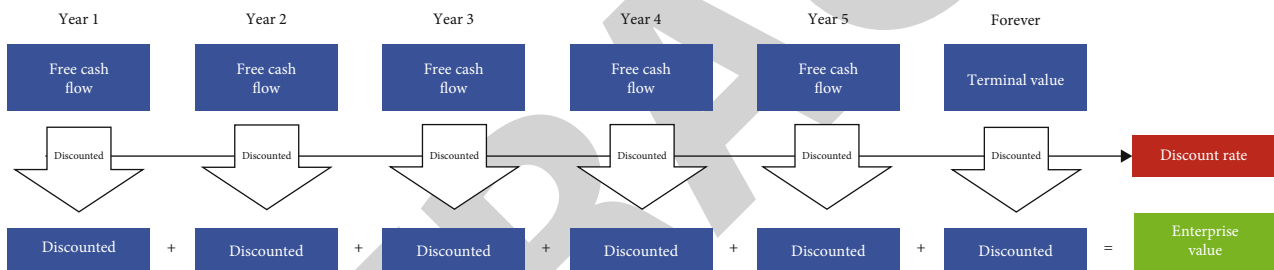


FIGURE 3: From free cash flow to enterprise value.

of the expected sales can predict the future free cash flow of each item in the future financial statements. The estimation of the future growth rate of an enterprise by this method often depends on subjective factors to a certain extent, so as to obtain the forecast result, because the ratio of each item to operating profit in the financial statements may be unstable for a long time.

3. Improvement of the DCF Model

Due to the limitations of the DCF model, it is necessary to improve this model first. The first is to simplify the calculation of FCF. Then, the sales percentage method is replaced by the time series analysis method to predict the future free cash flow. After simplifying the FCF calculation, various data can be extracted from the sale financial statements.

3.1. Simplified Calculation of FCF. In the FCF calculation formula proposed by Professor Copeland, the depreciation item is the depreciation expense incurred in the current period, and the balance sheet records the accumulated depreciation of fixed assets and intangible assets for many years. The amortization amount and amount of the current period are recorded in the notes of the financial statements,

so it is not easy to get data. Equipment investment projects consist of the increase of net operating long-term assets and depreciation and amortization. The above analysis results show that the data about depreciation and amortization items are the most difficult to extract, while other data can be extracted from the financial statements of administrators. Therefore, the simplified expression of free cash flow calculation is shown in $\text{free cash flow} = (\text{net operating profit after tax} + \text{depreciation and amortization}) - (\text{working capital increase} + \text{capital expenditure}) = (\text{net operating profit after tax} + \text{depreciation and amortization}) - (\text{working capital increase} + \text{net operating long-term assets increase} + \text{depreciation and amortization}) = \text{net operating profit after tax} - \text{working capital increase} - \text{net operating long-term assets increase}$.

After the FCF formula is simplified, it consists of three items, and its data can be obtained from the financial statements for management, thus simplifying the operation.

3.2. The Introduction of Time Series Analysis. When determining FCF parameters in the DCF model, it is assumed that the percentage and sales profit of each project are constant, the future growth rate is assumed, and the sales percentage and growth are both constant. In many cases, the

exchange rate is subjective to some extent. Therefore, we will introduce the famous time series forecasting model proposed by Bocks and Jenkins-ARIMA. The Y_t of the ARIMA model can be interpreted by its own historical data, hysteresis values, and random error terms. Depending on whether the original sequence is a stable time series and the different parts contained in the regression, it can be divided into four types: MA, AR, ARMA, and ARIMA.

Using time series analysis to determine FCF parameters, the first step is to determine the stability of FCF sequence. In the second step, if the FCF series is unstable, the FCF series can be converted into a stable series by performing the differential ADF test. The third step is to run the correlation test and determine the equation type of FCF sequence according to the autocorrelation and partial autocorrelation diagrams. The fourth step is to use the minimum variance parameter estimation method to select the model suitable for equation prediction. The fifth step is to perform correlation test on the residual sequence. If it is a white noise sequence, the test passes. In the sixth step, the FCF is predicted by using the result equation.

3.3. Applicability Analysis of Improved Model. The DCF model is also improved on the complete market assumption. If the external environment is a complete capital market, the assessed asset value is equal to its market price. The improved DCF model is suitable for enterprises with stable and sustainable operating environment.

Therefore, if the improved DCF model is used, the following preconditions must be met. First, the capital market is a complete capital market. Then, the sample enterprises are sustainable and there is no financial crisis. Secondly, the free cash flow of the sample company during the evaluation period is basically positive, and finally, the sample company will reach a steady state in the last year of the forecast period and grow steadily at this rate.

4. Buffett and Value Investment Theory

4.1. Introduction to Buffett. In the evolution of value investment theory, Warren Buffett, as a practitioner of value investment theory, has made outstanding contributions to the development of value investment theory system. Warren Buffett is known as "Oracle of Omaha" and "God of Shares." He was born on August 30, 1930, in Omaha, Nebraska, USA. Warren Buffett is naturally interested in investment and has a very strong interest in stocks and quantity. He first entered the stock market at the age of 11, when he also bought the first stock in his life. After graduating from high school in 1947, Buffett entered the University of Pennsylvania to study finance and business management. Two years later, he transferred to the University of Nebraska at Lincoln, and in the same year, he received his bachelor's degree in economics. In 1950, Buffett was admitted to Columbia University Business School and was taught by Benjamin Graham, a famous value investment theorist. After graduating from top students, Buffett and his companions started his legendary investment career by setting up a private investment com-

pany. The P/E ratio from March 3 to March 24, 2022, is compared with that of the last week, as shown in Table 2.

Buffett is an outstanding practitioner of value investing, and he has used his life's investment actions to prove the brilliance of value investment theory and maintain the dignity of value investors. But Buffett is not a good scholar or theorist. He did not even systematically conceptualize his theory. Perhaps, his theory is reflected in the writings of two teachers. He did not care about writing books at all, and probably, he would not mind teaching his apprentices all his experience and knowledge.

4.2. Value Investment Theory. Value theory mainly refers to finding undervalued enterprises from the market in several ways. According to the market efficiency theory, after a period of time, the market will be revised and the value will be rediscovered and redefined. If the price of the investment object rises, the investor will sell the investment object to make a profit. A more general method for value investment theory is to use the free cash flow model. Evaluate the original value of stocks.

In the theory of value investment, value investment is Graham's main investment logic. In his eyes, the first thing he sees when buying a stock is the actual value of the stock itself. When the essential value is relatively low, the safety rate is not high. If the market is in a panic or the economy is in the black market, the stock price may fall and appear a new low because it is not supported by the stock price.

4.3. Enterprise Intrinsic Value and Margin of Safety. Investors should first pay attention to two aspects when investing in value: one is the real value of the enterprise, which is the so-called intrinsic value, and the other is the safety margin of the enterprise stock. The intrinsic value of an enterprise can bear the risk of market deterioration and national economic slowdown, while the margin of safety enables investors to buy stocks without being affected by other stocks in the market and the stock price will continue to rise. The formula can be expressed as

$$1 - \frac{p}{v}. \quad (6)$$

p is the price of the stock, v is the intrinsic value of the stock, and the ratio of the two is the deviation degree. The greater the underestimation, the greater the margin of safety. When the company's annual net profit and assets are in good condition, its share price is not affected by the market, nor will it affect investors' expectations, so the margin of safety is very important.

If the yield of the stock price is 1, then the value of the stock market will be exactly equal to the original value, that is, there is no deviation. If the yield of the stock price is greater than 1, the stock price is higher than the intrinsic value. For stock prices between 0 and 1, that is, when the margin of safety is greater than 0, investors can make appropriate judgments based on their current ability to resist risks before buying. The increase of the securities market during June 10–17, 2022, is shown in Table 3.

TABLE 2: P/E ratio from March 3 to 24, 2022, compared with that from the last week.

| Index name | Price/earning ratio | PB ratio | 3/3 Last week | 3/10 Last week | 3/17 Last week | 3/24 Last week |
|---------------------------------|---------------------|----------|------------------|-------------------|-------------------|-------------------|
| Shanghai Index | 12.60 | 1.39 | ↓0.1 | ↓0.8 | ↓0.4 | ↑0.5 |
| Shanghai and Shenzhen 300 Index | 12.40 | 149.00 | ↓0.1 | ↓0.9 | ↓0.3 | ↑0.4 |
| Growth Enterprise Market Index | 52.90 | 6.52 | ↑2.9 | ↓5.3 | ↓0.4 | ↑2.1 |
| S&P 500 | 21.90 | 4.40 | ↑0.7 | ↓0.5 | ↑0.4 | ↑0.5 |
| Nasdaq Index | 32.50 | 5.23 | ↑1.3 | ↓1.1 | ↑0.4 | ↑1.1 |
| Nikkei 225 | 16.00 | 1.81 | — | ↓0.9 | ↑0.5 | ↑1.3 |
| Germany DAX | 14.80 | 1.69 | ↓1.7 | ↓1.5 | ↑3.1 | — |
| British FTSE 100 | 15.50 | 1.82 | ↑0.1 | ↓0.5 | ↑0.1 | ↑0.6 |
| France CAC40 | 15.40 | 1.78 | ↑0.1 | ↓1.8 | ↓0.2 | — |
| Hang Seng Index of China | 9.40 | 0.99 | ↓0.2 | ↓0.8 | ↓0.3 | ↑0.8 |
| Hong Kong Hang Seng Index | 10.50 | 1.05 | ↓0.2 | ↓0.7 | ↓0.3 | ↑0.8 |
| Russia RTS | 4.00 | 0.61 | ↓1.2 | — | — | — |

TABLE 3: Increase of securities market during June 10–17, 2022.

| | Main index | Weekly increase (%) |
|------------------------|---|------------------------|
| A shares | Shanghai Composite Index | 0.97 |
| | SSE 50 | 1.26 |
| | Hushen 300 | 1.65 |
| | Refers to GEM | 3.94 |
| | CSI 500 | 1.22 |
| | CSI 800 | 1.55 |
| The Hong Kong stock | Hang Seng Index | -3.35 |
| | Hang Seng Science and Technology Index | -3.59 |
| American stocks | Dow-Jones Index | -4.79 |
| | Nasdaq Index | -4.78 |
| | Standard & Poor's 500 | -5.79 |
| Europe | British FTSE 100 Index | -4.12 |
| | German DAX30 Index | -4.60 |
| | French CAC40 Index | -4.92 |

In real life, it is not easy for investors to find stocks with high intrinsic value but low market value, and they need to frequently search for undervalued stocks. When the investment market begins to develop irrationally, it is difficult for all investors to continue to enter the investment market rationally. At this time, when investors buy, the stock price will slowly rise and gradually become higher than the intrinsic value. Williams' discounted cash flow model is the most suitable model for evaluating the internal value of business. Generally speaking, the theory of value investment is mainly divided into two parts: qualitative indicators and quantitative indicators. The former includes macroenvironment and market conditions, while the latter includes free cash flow, origin value, and deviation.

4.4. Precautions before Investment. Before buying stocks, most investors are considering whether their stocks can be

essentially supported. If the external environment is bad or the company releases bad news about the stock price, then this stock is still enough to support the current stock price. This method can reduce investment losses and allow investors to maximize investment returns. If the external environment is good or the company releases good news, then the stock purchased in this way will often achieve a return that exceeds that of most investors in the market. Philip Fisher believes that when investors invest, they must first consider the profitability, future growth rate, and other factors of the enterprise and further investigate the hard conditions such as the quality of operation, research and development capabilities, and brand capabilities of the enterprise. And do not buy dozens or hundreds of stocks at a time, you should buy a few to see the market.

Because Buffett attaches great importance to the FCF index, which can reflect the company's operating conditions, stakeholders in financial statements will not deliberately and falsely increase the company's interests for specific interests when preparing financial statements. The simplest criterion for judging whether a company is good or bad is that it can create huge profits for investors in the next few years. This is Buffett's easiest way to judge whether business is good or bad. Having said that, we should give full consideration to the cash flow of the company.

5. Summary

This paper describes how to improve the DCF model through the time series analysis method of econometrics and then summarizes Buffett's value investment theory based on the improved DCF model. Two key aspects are improved: first, simplifying FCF calculation; second, using time series analysis instead of sales ratio method to predict future free cash flow.

Investors can use this article to carry out value investment surveys in other departments of the capital market, so as to improve the scientific nature of value investment surveys. The development of China's capital market and various systems is constantly improving, which will make it

more prominent in the future development and expansion of the capital market. Creativity and investment methods are constantly changing. Only when theory and practice are combined can we achieve the desired results at a stable speed.

Therefore, the improved DCF model can be used as the basic method of value investment research in China, which will enrich the research history of value investment in China. In order to improve the accuracy and scientificity of investors themselves, investors can use the survey method of this article to analyze and investigate the intrinsic value of other enterprises' stocks in other industries or capital markets.

Data Availability

The figures and tables used to support the findings of this study are included in the article.

Conflicts of Interest

The author declares that there are no conflicts of interest.

Acknowledgments

The author would like to show sincere thanks for those techniques which have contributed to this research.

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