

Research on Cash Flow Volatility and Earnings Stability and Enterprise Value Based on the Listed Companies of Shanghai and Shenzhen Stock Markets

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Abstract. In the evaluation of enterprise value, free cash flow model is more and more widely used because of its unique advantages. However, in previous studies, the valuation of enterprise value by free cash flow model was based on the previous data of the existing enterprises, and did not predict the future value of the enterprise. Based on this, in this study, the grey prediction model has been introduced into the process of enterprise value evaluation, and the comprehensive value evaluation of the enterprise has been obtained through the prediction of the free cash flow. In order to verify the feasibility of the method, with the Shanghai and Shenzhen A shares of a listed company as an example, according to the W company's annual report over the years, the company's market value is estimated. The estimation results show that the method is basically consistent with the stock price in the same year, which verifies the reliability of the method. Using the method of free cash flow volatility under different corporate value is estimated, the estimated results show that, the volatility of free cash flow have a certain impact on the valuation of the company, and the volatility and the negative correlation between the valuation of the company.

Introduction

The company valuation is one of the core content of financial management in modern company, which is a key field in academia and practice, and a theoretical system of large branches was formed. Apart from the traditional cost method, comparative method, modern corporate value theory research system is mainly carried out in several directions: discounted dividend theory (DDM), discounted cash flow theory (DCF) and residual income valuation model (RIM) and economic value added model (EVA), real option valuation theory. Among them, the discounted cash flow theory (DCF) model of free cash flow valuation is the most widely used model in practice at present, its volatility will affect the valuation of enterprises, thereby affecting the operation and development of enterprises, Introduction

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Free cash flow volatility impact on enterprise value

The volatility of free cash flow has an important influence on the enterprise, which is mainly manifested in five aspects, including the influence of unit profitability, enterprise value creation, investment behavior, cash and debt and market risk and other aspects, which will further affect the

enterprise value estimation.

The influence of enterprise profitability. In the valuation of corporate value, corporate profitability is one of the most important evaluation index, profitability and business ability and performance of enterprises is closely related to, the basic concept is the profit level of the enterprise organization. In the traditional methods, the evaluation of the profitability of enterprises is often based on the profit statement and the debt of the assets, and the profit level of the enterprise in a certain period is evaluated by mathematical accounting. This evaluation method only with responsibilities as an evaluation criterion, not effective evaluation of enterprise operational level and ability, and the combination of free cash flow, can make a comprehensive assessment of the enterprise, so as to realize the comprehensive valuation.

The influence of enterprise value creation. In the evaluation of the business activities, free cash flow is one of the very important index, because companies need to purchase raw materials and equipment in the operation, the recruitment of personnel and labor, these need to have sufficient free cash support, otherwise unable to expand these economic activities. If there is no free cash flow support, enterprises will not be able to carry out production activities, can not transform raw materials into products, so as not to obtain profits. For some Finance Companies, the volatility of cash flow will also affect the value of shareholders, in general, it will have a negative impact on further impact on the value of the enterprise.

The influence of enterprise investment behavior. For many companies, if there is no sufficient free cash flow stability, business investment will be greatly affected, because of the shortage of free cash flow or large fluctuations in financing and bond will produce more adverse effects, eventually to business unit of value management harm. Especially some companies with equity financing is the main mode of financing, the greater the impact of free cash flow will cause large fluctuations in bond financing atrophy, reduce business investment capacity, to further reduce the profitability of enterprises, and finally affect the enterprise value.

The influence of cash and liabilities. The volatility of free cash flow will directly affect the corporate cash holdings, especially those who rely mainly on external funds, free cash flow volatility is large, the enterprise will take the initiative to reduce the free cash flow, in order to enhance the enterprise's ability to repay debt, thereby reducing the interference free cash flow brings, so cash flow and enterprise resources the liabilities also have a certain relationship, the relationship between cash flow and performance in resource unit liabilities mainly inverse proportion relation.

The influence of enterprise market risk. In the fierce competition in modern market economy, the significance of cash flow to the enterprise, if the cash flow problems, then enterprises will face greater market risk, only to maintain a stable cash flow, in order to improve the ability of enterprises to withstand market risks, thus increasing the value of the enterprise.

Valuation model of free cash flow company based on Grey Prediction

The theory of free cash flow began in 1980s, which is one of the core theories of modern finance. After the theory was put forward, it has received a positive response from the academic circles. Free cash flow reflects the financial health of an enterprise and the ability to continue operations, evaluated by the free cash flow model of enterprise value, generally use the blubber model, if we consider the uncertainty of enterprise development, the model also has some limitations. In the assessment of the actual value of the valuation formula, generally divided into two parts, which is divided into two stages, the first stage companies need to consider the development of instability, thus become the forecast period, the second stage is the stage of stable development of the enterprise, called the infinite stage or sustainable period, the enterprise value is equal to the combination of the two part of the free the amount of cash, the concrete expressions are as follows Formula (1)

$$V_0 = \sum_{t=1}^{\infty} \frac{FCT_t}{(1+WACC)_t} + \frac{V_t}{(1+WACC)_t} \quad (1)$$

In Formula (1), $FCTt$ is the free cash flow for t years, Vt is the free cash flow for the next t years, $WACC$ is weighted average value of enterprise capital. Within the non stable period, free cash amount will show some volatility, it is not possible to free cash amount on each year for accurate prediction of the financial situation and a few years ago the company is known, the grey prediction model for the grey prediction model, because some information is known, is in line with some information the characteristics of the unknown, the following steps are set up for the grey prediction model.

(1) First order accumulation generation.

First of all, the first order accumulation is assumed, and the free cash flow is the original nonnegative data sequence with variable $X^{(0)}$.

$$X^{(0)} = [X^{(0)}(1), X^{(0)}(2), \dots, X^{(0)}(n)] \quad (2)$$

Then the first order cumulative generating sequence of $X^{(0)}$ is that

$$X^{(1)} = [X^{(1)}(1), X^{(1)}(2), \dots, X^{(1)}(n)] \quad (3)$$

In Formula (3),

$$x^{(1)}(k) = \sum_{i=1}^k x^{(0)}(i) \quad k = 1, 2, \dots, n \quad (4)$$

(2) When the quasi smooth test and $X^{(1)}$ quasi exponential law test of free cash volume $X^{(0)}$ sequence are carried out, We make the following hypothesis

$$\rho(k) = \frac{x^{(0)}(k)}{x^{(1)}(k-1)} \quad k = 2, 3, \dots, n \quad (5)$$

If satisfying $\rho(k) < 1$, $\rho(k) \in [0, \varepsilon]$ ($\varepsilon < 0.5$), and $\rho(k)$ shows a downward trend, $X^{(0)}$ is called quasi smooth sequence, and $X^{(1)}$ has quasi exponential law. Otherwise, we need to weaken the data first, and the processing formula is

$$x^{(0)}(k) = \frac{1}{n-k+1} (x(k) + x(k+1) + \dots + x(n)) \quad k = 1, 2, \dots, n \quad (6)$$

And, $x^{(0)}(k) = x^{(0)}(k)$, that is, $X^{(0)}$ is replaced by $X^{(0)}$.

(3) From the second step, it is shown that $X^{(1)}$ has the law of exponential growth, so it can be considered that the sequence $X^{(1)}$ satisfies the following first order linear differential equation

$$\frac{dx^{(1)}}{dt} + ax^{(1)} = u \quad (7)$$

Solved it, we can get Formula (8)

$$\begin{bmatrix} \hat{a} \\ \hat{u} \end{bmatrix} = (B^T B)^{-1} B^T Y_n \quad (8)$$

In Formula (8),

$$Y_n = \begin{bmatrix} x^{(0)}(2) \\ x^{(0)}(3) \\ \vdots \\ x^{(0)}(n) \end{bmatrix}, \quad B = \begin{bmatrix} -\frac{1}{2}[x^{(1)}(1) + x^{(1)}(2)] & 1 \\ -\frac{1}{2}[x^{(1)}(2) + x^{(1)}(3)] & 1 \\ \vdots & \vdots \\ -\frac{1}{2}[x^{(1)}(n-1) + x^{(1)}(n)] & 1 \end{bmatrix} \quad (9)$$

The obtained \hat{a} and \hat{u} can be substituted into the differential equations

$$\frac{dx^{(1)}}{dt} + \hat{a}x^{(1)} = \hat{u} \quad (10)$$

(4) Establishment of grey prediction model

The grey prediction model of cumulative sequence $X^{(1)}$ can be obtained by differential equation (10)

$$\hat{x}^{(1)}(k+1) = [x^{(1)}(0) - \frac{\hat{u}}{\hat{a}}]e^{-\hat{a}k} + \frac{\hat{u}}{\hat{a}} \quad k = 0,1,2,\dots,n \quad (11)$$

If $X^{(1)}$ is a sequence obtained by the first weakening treatment of $X^{(0)}$, then the first-order weakening reduction can be obtained

$$\hat{x}^{(0)}(k+1) = \hat{x}^{(1)}(k+1) \quad (12)$$

Do these reduction, get grey prediction model for $X^{(0)}$

$$\hat{x}^{(0)}(k+1) = (e^{-\hat{a}} - 1)[x^{(0)}(n) - \frac{\hat{u}}{\hat{a}}]e^{-\hat{a}k} \quad k = 0,1,2,\dots,n \quad (13)$$

By using the grey prediction model, the free cash flow in the unknown period can be predicted by using the free cash flow data of the known age, and the influence of the volatility of the free cash flow on the valuation of the company is obtained.

Application analysis of corporate valuation case based on free cash flow

In order to verify the feasibility of the grey forecasting model of free cash flow to the valuation of the company, taking a listed company of A shares as an example, hereinafter referred to as the W company. According to W company's annual calendar year, W company listed in 2011, the total share capital of 600 million shares, the total assets of 2 billion 500 million yuan, is a large company's financial strength is strong, the influence of the market is large, using Formula (1) can realize the value of the company estimates, according to W company 's six annual data report, the six years of free cash flow as shown in Table 1.

Table 1 The annual free cash flow of W company

Year	2011	2012	2013	2014	2015	2016
<i>FCT</i> _{<i>t</i>}	1.36	1.56	1.78	1.75	1.16	1.65

As shown in Table 1, since the annual report data is small, only six years of free cash volume data. According to the data provided in Table 1, we can use the grey prediction model, first of all, the cumulative generation sequence is solved

$$\begin{aligned} x^{(1)}(k) &= [x^{(1)}(1), x^{(1)}(2), \dots, x^{(1)}(n)] \\ &= (1.36, 2.92, 4.70, 6.45, 7.61, 9.26) \end{aligned} \quad (14)$$

According to the formula model and steps in the previous section, the data are calculated sequentially, and the calculated data is substituted into Formula (1) to estimate the value of the company

$$V_0 = \frac{1.35}{1.058} + \frac{1.21}{1.058^2} + \frac{1.18}{1.058^3} + \frac{1.29}{1.058^4} + \frac{1.08}{1.058^5(0.0625 - 0.048)} = 7200 \text{ millions yuan} \quad (14)$$

Using 7200 millions yuan divided by 600 million capital stock, the average price per share is 12 yuan, which is close to the price of 13.5 yuan per share, so it shows that the estimation method is reasonable, which verifies the feasibility and reliability of the method.

Table 2 Effect of cash flow volatility on the valuation of the company

Year	2011	2012	2013	2014	2015	2016
Fluctuation range of free cash flow	30.5%	42.1%	12.5%	8.2%	7.3%	5.5%
Company valuation (100 million yuan)	59.6	56.1	65.3	76.2	78.4	79.3

As shown in Table 2, in order to verify the volatility of the cash flow valuation of the company, the value of the company was estimated by the estimation for different cash flow volatility. From the estimation results, we can see that the volatility of free cash flow has a certain impact on the company's valuation, and with the gradual increase in volatility, the company's valuation has a downward trend.

Conclusion

Free cash flow is one of the main indicators of the evaluation of business activities and financial conditions, the volatility of enterprises especially influence the valuation of financing of enterprise value. This study uses grey forecasting model to improve the enterprise valuation model based on free cash flow, and can predict the future value of the enterprise on the basis of the existing financial data. In order to verify the reliability of the model, taking the listed companies for example, using the grey forecasting model of the enterprise value was estimated. The estimation results show that the method can obtain more accurate value estimation of enterprise. At the end of the free cash flow volatility amplitude of the enterprise value was estimated by using this method, the estimated results show that, the free cash flow volatility and firm value has a negative correlation.

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