



Advantages and Disadvantages of Dividend Discount Model and Better Alternatives

Jingning Xu

University of Kentucky
892428199@qq.com

Abstract

The dividend discount model (DDM) is an efficient stock market value valuation model, which takes dividends as the primary analysis goal to predict and analyze the price of the analyzed stock. According to the existing formula and principle of DDM, taking Iflytek Co., Ltd. as an example to analyze the applicability and defects of DDM. In addition, combined with the analysis of another mode that can replace DDM - discounted cash flow. Therefore, the practicability of DCF and its comparison with DDM are analyzed. The conclusion is that DDM is practical. However, due to the instability of the dividend market, the result has a particular error. Therefore, the DCF model can be used instead. Furthermore, the DCF model can provide more detailed and long-term analysis, and the results obtained by DCF model are relatively reliable.

Keywords: Dividend Discount Model, The intrinsic value of the stock, Iflytek, Alternative model

1. Introduction

The Dividend Discount Model (DDM) is one of the most important entity models for evaluating the intrinsic value of individual stocks. In 1938, Williams and Gordon clearly proposed the dividend distribution and exchange entity model (DDM) for evaluating enterprises (individual stocks), which established a theoretical basis for the qualitative analysis of virtual assets, property and company values, and also provided the fundamentals of stock investment^[4]. (Fabozzi & Frank, 2008). The main core content of this basic theory is that the use-value that a stock should have is intrinsic value, not its price. The intrinsic value of an individual stock can be assessed according to the sum of the discount rates of the dividend distribution income of the individual stock each year. This paper will make a detailed and comprehensive analysis to explain the detailed application of DDM in various situations and conduct an example analysis of DDM according to the example analysis of Iflytek Co., Ltd. Use the example analysis of Iflytek Co., Ltd. to compare the accurate market value and analyze the advantages, disadvantages and limitations of DDM.

2. Dividend Discount Model

In the finance field, the dividend discount model, or DDM, is a method used to value a stock based on the idea that it is worth the sum of all of its future dividends,

which is a method of calculating the value of a company, an absolute valuation method^[4] (Fabozzi & Frank, 2008). Most of Knowledge below about DDM come from Investments by Bodie in 2003 and the book Principles of Corporate Finance Richard in 2011.

2.1. General model

The real or intrinsic value of any asset is the future cash flow received by the investors who own it. The expected cash flow of stock refers to the dividends paid to shareholders or the net cash flow from the operations of the company. When investors buy a stock, they expect to receive two kinds of cash flow: the dividend they will receive while holding the stock and the expected price of the stock at the end of the stock. Since the expected price at the end of the stock is determined by the future dividend of the stock, the formula is as follows:

$$P_0 = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \dots = \sum_{t=1}^{\infty} \frac{D_t}{(1+k)^t} \quad (1)$$

P_0 : Stock price, D_t : Stock price, D_t : Expected dividend payout in time t, k: Yield to Maturity

This formula says that the price of a share is equal to the present value of the sum of all its expected future dividends. The theoretical basis of the dividend discount model is the present value principle, that is, the value of any asset is equal to the sum of the present value of its

expected future cash flows, The discount rate used to calculate the present value should match the risk of the cash flow. The return on equity capital required by investors is determined by the risk of cash flow, and different models have different indexes to measure the risk. In general, the dividend discount model is flexible, which allows us to account for different discount rates due to changes in expected interest rates or risk over time.

2.2. The specific form of dividend discount model

According to the different distribution of dividends, DDM can be divided into the following types:

2.2.1. Zero Growth Model

The dividend growth rate is 0, and future dividends will be issued at a fixed amount. The formula is as follows:

$$V = \frac{D_0}{k} \quad (2)$$

V: Stock price, D_0 : Stockprice, D_0 : Expected dividend payout, k: Yield to Maturity

2.2.2.DDM with Constant Growth (Gordon Growth Model)

The dividend grows at a constant rate of growth g. The formula is as follows:

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k)^t} = \sum_{t=1}^{\infty} \frac{(1+g)^{t-1} D_1}{(1+k)^t} = \frac{D_1}{r-g} = \frac{1+g}{r-g} D_0 \quad (3)$$

if $r > g$ (Gordon Growth Model)

P_0 : Stock price, D_t : Expected dividend payout in time t, r: Yield to Maturity

g: Growth rate of dividends and earnings

2.2.3. Two-stage growth model

The two-stage growth model is a model that simplifies the development of a company into two stages. The growth patterns in these two stages are different, and the dividend policy is also very different. The basic assumption of the two-stage growth model is that a company will inevitably go through two stages in its development process: the initial development stage with high growth rate and the steady growth stage after the high growth rate. According to that information, the intrinsic value of a stock is expressed by the formula:

$$P_0 = \sum_{t=1}^n \frac{DPS_t}{(1+k)^t} + \frac{P_n}{(1+k)^n} \quad (4)$$

Combining the formula for the price-earnings ratio:

$$P/E = \frac{P_n}{ESP_n} = \frac{P_n}{[ESP_n \times (1+g)^n]} \quad (5)$$

From this, the present value of the stock is equal to:

$$P_0 = \frac{DPS_0(1+g)}{(1+k)} + \dots + \frac{DPS_0(1+g)^n}{(1+k)^n} + \frac{EPS_0(1+g)^n(P/E)}{(1+k)^n} \quad (6)$$

DPS_0 : Dividend per share, EPS_0 : Earnings per share, g: Growth rate of dividends and earnings, P/E: Price-earnings ratio, k: Required Rate of Return

Calculation of parameters in the two-stage growth dividend discount model:

$$g = (1-b) \times [ROA + (D/E) \times (ROA - R_D)] \quad (7)$$

In this formula, b is the dividend payout ratio, which is calculated as:

$$b = \frac{\text{Dividend Per Share}}{\text{Earnings Per Share}} \quad (8)$$

$$\text{Return on Assets (ROA)} = \frac{\text{Net Income}}{\text{Total Assets}} \quad (9)$$

$$\text{Debt-to-equity ratio (D/E)} = \frac{\text{Total Liabilities}}{\text{Total Shareholders' Equity}} \quad (10)$$

In addition, CAPM can be used as the most basic estimation method for the analysis and estimation of market risk.

$$k = r_f + \beta(r_m - r_f) \quad (11)$$

r_f is the risk-free interest rate, which represents the interest rate that capital can get by investing in an investment object without any risk. r_m is the market's expected rate of return, and $(r_m - r_f)$ is the risk premium, which is the expected return for investors who take on the non-diversifiable risk associated with the stock market. The formula for calculating the beta coefficient is as follows:

$$\beta = \frac{\text{cov}(r_m, k_i)}{\sigma_m^2} \quad (12)$$

3. DDM Application case: Iflytek Co.,Ltd

3.1. Basic information

Iflytek Co.,Ltd is a company engaged in the Internet and high-tech. The company mainly conducts research on high-tech, involving speech recognition, intelligent voice calls, electronic chips, software products and so on. Due to the good prospect of market development and steady development of the company, Iflytek was listed on the stock exchange in 2008, and its stock code is: 002230.

As the epidemic has affected many industries in recent years, the stock price fluctuates greatly, so Iflytek's data of representative years are selected to calculate. Based on the basic information of Iflytek and the financial annual report data for the seven years from its listing in 2008 to 2014, Iflytek has a high price-earnings ratio, which is in line with the characteristics of

stocks with high growth potential. Therefore, the following will use the two-stage growth model in the dividend discount model to calculate the intrinsic value of Iflytek.

Table 1. Iflytek 2008-2014 Dividend Per Share, Earnings Per Share, P/E Ratio ^[3]

Year	2008	2009	2010	2011	2012	2013	2014
Dividend per share	0.034	-	-	-	0.17	0.16	0.174
Earnings per share	0.71	0.5	0.63	0.53	0.48	0.64	0.47
Annual P/E ratio	48	98	144	104	58	-	119.23

(CapitalIQ, 2022)

Table 2 Key Financial Indicators of Iflytek in 2014 ^[3]
(CNY in thousands)

Total Assets	Total Liabilities	Net Assets	Net Profit
516,990.00	126,848.00	390,142.00	38,848.70
Non-current Assets	Accounts Payable	Advance Payment	EPS
19,255.70	46,779.10	13,494.50	0.47

(CapitalIQ, 2022)

3.2. Growth rate of asset

In order to make the dividend payout ratio closer to the actual level, the ratio of the sum of dividend payments to the sum of distributable profits from 2008 to 2014 can be used as the *b* value. But Iflytek in 2008 to 2012 almost no dividends were paid for four years. The dividend payout data from 2012 to 2014 is relatively stable. In order to obtain more accurate dividend payout data, the average dividend from 2012 to 2014 is used to calculate the dividend payout ratio *b* of Iflytek.

$$DPS = \frac{0.17 + 0.16 + 0.174}{3} = 0.168$$

$$EPS = \frac{0.71 + 0.5 + 0.63 + 0.53 + 0.48 + 0.64 + 0.47}{7}$$

$$= 0.566$$

$$b = \frac{0.168}{0.566} = 0.3$$

$$ROA = \frac{38848.7}{516990} = 7.51\%$$

$$D/E = \frac{126848}{392142} = 32.35\%$$

Earnings per share and Dividends per share in 2014 can be obtained from the financial statements that is $EPS_0 = 0.47$, and $DPS_0 = 0.174$.

Debt interest rate R_D refers to the interest on long-term debt. From the 2014 balance sheet of Iflytek, we can see that the total liabilities are 126,848, and the current liabilities are 107,592. It can be seen that the current liabilities account for a large proportion, so R_D is set to 0.

$$\begin{aligned} g &= (1 - b) \times [ROA + (D/E) \times (ROA - R_D)] \\ &= (1 - 0.3) \times [7.51\% + 32.35\% \times (7.51\% - 0)] \\ &= 0.07 \end{aligned}$$

3.3. Required Rate of Return (*k*) and β

According to CapitalIQ, β of Iflytek is equal to 1.2072 in 2015.

The risk-free interest rate can choose the long-term treasury bond interest rate as the benchmark, but the long-term treasury bond interest rate lacks a unified standard. Therefore, the short-term fixed deposit rate is selected as the risk-free rate.

$$\begin{aligned} k &= 2.5\% + 1.2072 \times 8\% \\ &= 12.16\% \end{aligned}$$

3.4. The intrinsic value of Iflytek

$$\begin{aligned} P_0 &= \frac{0.174 \times (1+7\%)}{(1+12.16\%)} + \dots + \frac{0.174 \times (1+7\%)^5}{(1+12.16\%)^5} + \\ &\frac{0.47 \times (1+7\%)^5 \times 80}{(1+12.16\%)^5} \\ &= 0.17 + 0.16 + 0.15 + 0.14 + 0.13 + 23.67 \\ &= 23.42 \end{aligned}$$

Using the two-stage growth model, the intrinsic value is 23.42, while the closing price of Iflytek Co., Ltd stock on December 30, 2014, is 26.27. Although there is a deviation between the intrinsic value per share and the market value calculated by the dividend discount model, the difference is not apparent. It fully shows that the dividend discount model is an effective method to analyze and evaluate the internal value of enterprises. Although it can be said that DDM can effectively predict the stock value, there is still some gap between the valuation and the actual stock market value. So, what is the reason? The reasons will be explained in detail in the next chapter.

4. Disadvantages and limitations of Dividend Discount Model

In 1934, British economist Williams first explicitly put forward the entity model of dividend distribution exchange ^[4] (Fabozzi & Frank, 2008). At that time, the main purpose of investors buying and selling stocks was indeed to receive dividends. Dividend yields on individual stocks are often compared to bond returns. As everyone knows, since the mid-20th century, listed

companies have gradually reduced the distribution of dividends due to tax considerations. Many companies tend to save most of their earnings for reinvestment in projects to prevent the company's shareholders from paying large dividend distribution taxes^[10] (Shaikh, 2009). When a business must manage a portion of its funds to the company's shareholders, it usually chooses to buy back shares rather than pay dividends. This kind of thing makes the dividend distribution exchange entity model unable to solve.

First, the scope of application of the revenue-enhancing entity model is limited. The prerequisite for using the revenue-enhancing entity model is that the management of the new project or company is sustainable and stable, and the future cash flow can be estimated^[7] (Ota, 2001). The dividend distribution increase method is suitable for companies with obvious and stable dividend distribution. For non-cyclical sectors, discomfort is used for companies and cyclical sectors with very small or volatile year-end dividends.

In addition to this, the investment model does not take into account the existence of non-tradable shares. The dividend distribution exchange entity model is evaluated based on the exchange value of each dividend distribution. The entity model treats all individual stocks equally, but the distinction between non-tradable shares and stock market value makes individual stocks of the same company of different varieties have different transaction prices^[1] (Bask, 2020). Naturally, there must be a reasonable sales market investment model.

Ultimately, the financial accounting data information on the sales market reflects the error of the message. Although the cash flow discounted entity model does not need financial accounting to make profits, the cash flow comes from the production and operation of the enterprise. However, when applying the cash flow discounted entity model, most of them choose the financial accounting profit plus the cost of monetary discharge to obtain the data information of "cash flow". Because the table data information itself is relatively limited, it will endanger the actual effect of the entity model valuation^[5] (Jel & Sr-Id, 2015). Even if the specific production and operation conditions of the two companies are the same, because of the differences in financial accounting solutions and accounting estimates, the relevant data and information in the financial statements of the two companies are also different, which are greatly affected by the subjective reasons of accounting. Valuation of accounting information, thereby significantly jeopardizing the accuracy of valuation.

5. Alternatives to the Dividend Discount Model

5.1. Discounted Cash Flow Model (DCF)

The discount method converts future cash flows into estimated cash flows, and then discounts the estimated cash flows to an effective discount rate. The key to applying these methods is to identify the estimated cash flow for each year that the business plans to have; secondly, to find an effective, fair and equitable discount rate.

The value-in-use evaluation refers to the value judgment made by both parties of the transaction on the collateral. In essence, it is an objective distinction, but it cannot be judged casually. Instead, there are special and effective methods to base it on. The company can generally take various methods to carry out the valuation of the direction of the company. For example, the cash flow exchange method is a more logical method based on cash flow forecast analysis, taking into account the harm to the use value of the overall target enterprise planning's ability to create cash flows^[8] (Penman & Sougiannis, 1998).

DCF model belongs to the absolute valuation method. The specific approach is: assuming that the enterprise will proliferate for several years and then grow steadily for several years, it is usually necessary to predict all the free cash flow earned in the future for 15-30 years and convert it into the current value with the discount rate (WACC). In this way, the current value of the stock comes out. Suppose valuation > current share price → current share price is undervalued. The investors could buy the stock in. The value of if valuation stock is equal to the discounted value of its future cash flow, no more or no less. The company's value depends on the net value of the discounted cash flow created by the company in the future (during the rest of its life). Enterprise cash flow is the net cash flow disposable by all equity and creditor investors, also known as enterprise free cash flow. Free cash flow (FCFF) = (NOPAT) net operating profit after tax - working capital expenditure - capital expenditure = (EBIT) EBIT * (1 - corporate income tax rate) - working capital expenditure - capital expenditure + depreciation.

According to the data of CapitalIQ, the development of Iflytek Co., Ltd. has been relatively stable in the past few years. In the part of financial analysis, it can be seen that the company's financial situation in 2015 is good, and it can be predicted that the company will have good development prospects in the future. Therefore, we assume that Iflytek Co., Ltd. will have a growth rate of 30% in the next five years. Based on this, we predict the free cash flow of Iflytek Co., Ltd. in the future and make some modifications in combination with the characteristics of the industry.

Iflytek Co., Ltd.'s profit before interest and tax (EBIT) in 2015 was 420 million CNY; Capital expenditure was 330 million CNY. The accumulated depreciation is 26 million CNY; The sales revenue is 2500 million CNY. The working capital is 188.65 million CNY. In the first year, EBIT was 420 million * (1 + 30%) \approx 540 million CNY, and the growth rate of capital expenditure was 30%, so capital expenditure = 330 million * (1 + 30%) \approx 430 million CNY. If the average annual depreciation growth rate is 30%, depreciation = 26 million * (1 + 30%) \approx 33 million CNY, working capital change = 2500 * (1 + 30%) * 7.5% - 2500 * 7.5% \approx 56 million CNY. To sum up, the conclusion could be the free cash flow of the enterprise is 33.1775 million CNY.

According to the data of capital IQ, the interest rate of Chinese government bonds in 2015 was 3.99%. Then the risk premium is the average social rate of return, excluding the risk-free rate of return, which is 9.59%. According to CapitalIQ, the β of Iflytek Co., Ltd. is equal to 1.2 in 2015. Finally, it can be concluded that the cost of equity capital is the risk-free rate of return plus β . The result is about 12.12%. If the asset-liability ratio is 22%, the weighted average cost of capital (WACC) is the cost of debt capital * 22% plus the cost of equity capital * 78%, equal to 10.5%. The resulting price is about 27 CNY. The actual distance from the actual price has narrowed. At present, Iflytek Co., Ltd. growth is one of the best in the industry. If the company is valued according to the industry's growth rate, the share price should be greater than 32 CNY. Compared with the current share price, the stock may have been underestimated.

The specific drawback of the discounted cash flow method is its inherent variability in the probable and forecast analysis of cash flows. In addition, the accuracy is reduced because many assumptions are made about the sales market, commodities, prices, market competition, management methods, economic development, annual interest rates, etc. However, in every merger and acquisition, the exchanged cash flow method should be applied because it focuses on the most important assumptions and variability, and the key point is that its conclusions have key practical value when used to determine the maximum price for the buyer ^[6] (Nasir, Muhammad & Ashraf, 2014).

5.2.DDM contrast with DCF Model

The DDM model is suitable for companies and non-cyclical fields with large and stable dividends at the end of the year, but it is not suitable for companies with small or unstable dividends at the end of the year. As everyone knows, the DCF valuation method is the most careful and meticulous way of valuing companies and stocks. Therefore, this entity model is applicable to all enterprises. At this stage, the extremely common DCF valuation model has given a more careful and detailed

research structure than DDM, systematically considered every element that jeopardizes the value of the company, and finally assessed the investment value of a company ^[11] (Sigeo, 2012). The difference between the DCF valuation method and the DDM is that the DCF valuation method replaces the dividend distribution with the cost of equity capital. Cash flow replaces dividend distribution, and dividends are more scientific and reasonable, and less susceptible to human factors.

As everyone knows, in general, dividend distribution is not equal to no-share cash flow, sometimes high and sometimes low. The advantage of the DCF entity model is that it contains a more complete evaluation index system than other common strongly recommended evaluation index systems, and is the most rigorous but relatively complex evaluation index system ^[12] (Sutjipto, Setiawan & Ghozali, 2020). To fully consider the long-term development trend of enterprises, more and more information and a more comprehensive perspective must be obtained. Thus, the accuracy of the solid model is greatly compromised by the keyed values.

6. Conclusion

Finally, this paper describes the specific concepts and contents of DDM as a whole, including concepts, elements and formulas. The stock price of Iflytek Co., Ltd. is predicted according to the formula of DDM. The conclusion confirms the role of DDM with a relatively small gap. The above corresponding analysis and examples confirm that DDM is effective and can predict the stock price of the market relatively accurately. However, there is a particular gap. This gap is mainly caused by factors such as the unpredictable situation of the market, and the different accounting standards and the uncertainty of the company's dividend. In addition, among the models for predicting stock prices, the DCF model is based on DDM, which is also very important and one of the more popular valuation models today. Here, the differences between DDM and DCF models are compared. For example, dividends are replaced by cash flow. Because cash flow has more advantages in replacing dividends, the analysis of the DCF model is more complex but more detailed such as the DCF model needs to consider every factor that jeopardizes the value of the company. Therefore, DCF model is suitable for long-term prediction and observation of the company and has more advantages than DDM.

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