

Optimization Study of the Improvement on DDM Model Based on Poly Union Group Corporation

Longxuan Xin*

Shanghai Pudong Foreign Language School, Shanghai 201203, China

*Corresponding author: lfarrq50957@student.napavalley.edu

Abstract. With the global economic develops, stock market has aroused the attention of investors, which enables them to invest capital in it. However, the DDM that investors use has various disadvantages, which have been misleading them to get wrong conclusions. Thus, this paper will have further analysis and research on the weakness of the DDM and propose elaborate improvement. The paper uses the GGM model to value the stock price based on the actual dividend paid by the company and for the simplicity of calculation. The research shows that the DDM ignores the growth of the company and the risk factor. Furthermore, the DDM isn't suitable for stocks whose growth of dividend is higher than the discount rate. The PEG model can give accurate valuations for stocks that have zero dividend yields or very trivial ones. In general, the PEG model can improve the DDM model. But still, the PEG model doesn't take the cash amount on the balance sheet into account. Company with a certain amount of cashflow might be more valuable for investors. In the future, something should be added to modify the PEG model.

Keywords: Dividend discount model; price earning ratio; investor; improvement; stock.

1. Introduction

As investors' investment philosophies become more rational, investors are paying more and more attention to the intrinsic value of stocks. They judge whether a stock has investment value by a reasonable valuation of it. DDM is a proven method of predicting the intrinsic value of each share by discounting future dividends. But it does not apply to all companies. Studies have shown that there are some variants of DDM. The Gordon Growth Model assumes that the dividend growth rate doesn't change. It was first popularized by Myron. J. Gordon. Besides, the Temporary Supernormal Growth Model takes into account periods of constant growth and periods of high growth. But both models fail when the dividend growth rate is higher than the company's returned rate or company do not offer dividends. Thus, it is very meaningful to study the intrinsic value of the stocks of these companies. This study is based on the formula of DDM and analyse the drawback to get the improvement of DDM using the property of the infinite series of the power function. First, this study collect the data of the company and apply them to various formulas to get the growth rate of dividend, the amount of cashflow and the discount rate. Then, the stock price is calculated using the DDM model and the PEG model separately. Finally, this study compares the result of both methods to find out which one is better.

2. Literature Review

2.1. The Definition of DDM

DDM (Dividend Discount Model) is a quantitative analysis method to assess the fair value of current stock of the company by discounting the sum of the company's dividends in the future. It believes that the intrinsic value of a stock is the sum of the present value of expected dividends in the future.

2.2. The Formula of DDM

The formula of DDM is

$$V_0 = \sum_{t=1}^{\infty} D_t / (1+r)^t = \sum_{t=1}^{\infty} D_0(1+g)^t / (1+r)^t \quad (1)$$

V_0 is the stock's current value, D_t is the expected dividend to be paid in the year t , g is the dividend's constant growth percentage and r is the necessary yield or discount rate of the stock [1]. Since the necessary rate of return is greater than the fixed rate of dividend growth, $(1+g)/(1+r) < 1$, the property of the infinite series of the power function can be used here

$$x^1 + x^2 + x^3 + \dots + x^n + \dots = x / 1 - x \quad (2)$$

So the formula of DDM can be simplified as

$$V_0 = D_0(1+g) / (r-g) = D_1 / (r-g) \quad [1] \quad (3)$$

2.3. The Introduction of Poly Union Group Corporation

Poly Union Group Corporation was established on July 18, 2002 and listed on the Shenzhen Stock Exchange on September 8, 2004 under the stock code 002037 [2]. Its main business is the research and development, production, sales, blasting and distribution, engineering service technology, design and construction of civil explosive equipment products [3]. The main products are explosives, pipe locks, blasting and engineering construction [3]. Among them, blasting engineering construction is the main source, accounting for 61.54% of revenue, followed by the revenue brought by explosives, accounting for 28.27%, and again the revenue of pipe locking, accounting for 7.74% [3]. Its net profits in the 2016-2020 financial statements were 61.94 million yuan, 151.5 million yuan, 177.4 million yuan, 146.4 million yuan and 125.9 million yuan, respectively [3]. According to this, it can be clearly seen that the company has a constant series of cashflow. The company also has a certain profitability and the development trend is stable and improving.

2.4. The Definition and Formula of PE

The PE (price-earning ratio) is the quotient of stock's market price to earnings per share, expressed as a multiple of stock price per share [4]. It can tell investors the level of the stock price, indicating how many times the profit of the investor is willing to invest in the company, which is the market's evaluation of the stock [4]. Thus, the PE tells the investors how much money they should pay to get the profit of 1 unit of the currency from the company if they buy the stock of it. And the formula of PE is

$$PE = P / E \quad (4)$$

The formula can also be rewritten as

$$P = PE \times E \quad (5)$$

2.5. Earnings Analysis

The earnings analysis method can evaluate the stock's price using the product of its price-earning ratio and earnings per share [4]. By comparing the stock's worth with the stock price, the investor can see whether the stock is worth investing in [4]. It is generally believed that a high price-to-earnings ratio of a stock infers that investors have full trust in the future of the company and are willing to pay more for every \$1 surplus while a low price-to-earnings ratio indicates that investors are pessimistic about the company's prospect and are unwilling to enlarge investment for every one of surplus [4].

2.6. Capital Asset Pricing Model

The capital asset pricing model studies the relationship between the expected rate of return of assets and risky assets in the securities market [5]. It assumes that every investor takes Markowitz's asset selection theory to help them with making decisions. Also, the model assumes the same estimates of expected returns, variances, covariances and investors being free to get money from the bank [5]. Based on the model, the main idea of its research is to investigate the quantitative

relationship between the return of risk assets and risk, that is, how much return investors should receive for the sake of compensation for risk to a certain extent [5].

The formula of Capital Asset Pricing Model is:

$$E(r_i) = r_f + \beta_{im}(E(r_m) - r_f) \quad (6)$$

$E(r_i)$ is the expected rate of return of asset i , r_f is the risk-free rate and β_{im} is [[beta]], which is the systemic risk of asset i [3]. $E(r_m)$ is the expected return of the market m . $E(r_m) - r_f$ is the market risk premium, which is the difference between the expected market return and the risk-free return rate [3].

2.7. Weighted Geometric Mean

The weighted geometric mean is calculated by the weighted method when the number of variable values is not equal [6]. It is the result of opening the power of the product of the values of each variable [6]. Weight is the proportion of an individual among the whole. Its main use is to average ratios, indices, etc., and calculate the average development rate [7]. The formula of weighted geometric mean is

$$G_n = \sqrt[n]{\sum_{i=1}^n f_i \sqrt[n]{X_1^{f_1} X_2^{f_2} X_3^{f_3} \dots X_n^{f_n}}} \quad (7)$$

3. Methods

3.1. The DDM model

3.1.1 The determination of the growth rate of dividend

This study assumes that the Poly Union Group Corporation has a constant growth rate of dividend (see Table 1).

Table 1. Dividend per share of the Poly Union Group Corporation from 2018-2022

Year	2018	2019	2020	2021	2022
Dividend per share	0.047	0.073	0.06	0.052	0.043

Source: <https://www.doc88.com/p-7495651190587.html> [8]

Since the actual growth rate of dividend each year is not always the same according to the data of the Poly Union Group Corporation from the www.10JQKA.COM.CN in the recent 5 years, the formula of the weighted geometric mean should be used here.

So the constant growth rate of dividend is

$$g = \frac{0.043}{0.047} - 1 = -2.20\% \quad (8)$$

3.1.2 The determination of the discount rate

This study uses capital asset pricing model to estimate the expected rate of return of the Poly Union Group Corporation and uses the result as the discount rate to value the stock. Also, this study uses the 5-year government bond interest rate 3.52% announced by the central bank in 2022 as the risk-free rate [9].

According to China kernel network, the β from 2016 to 2020 on average of the Poly Union Group Corporation is 0.921[3]. Besides, this study is based on the historical closing price of the CSI 300 index from 2007 to 2020, using the geometric mean method to get the expected market rate of return that is 6.07% [3]. Thus the expected rate of return is

$$3.52\% + 0.921 \times (6.07\% - 3.52\%) = 5.87\% \quad (9)$$

3.1.3 The calculation of the stock price

According to the diagram above, the dividend of year 2022 is 0.043 per share. With the formula of GGM model, the stock price in year 2022 is

$$0.043 \times [1 + (-2.20\%)] \div [5.87\% - (-2.20\%)] = 0.52 \quad (10)$$

The price of stock in 2022 on average is 10.94 according to www.10JQKA.COM.CN. The error rate is $(0.52 - 10.94) \div 10.94 = -95.25\%$.

3.2. The PEG model

Table 2. PE of 5 companies

Company	Nanling civil explosion	Forbon	Xuefeng Technology	Cathay Group	Tongde Chemical	on average
PE	28.17	26.10	29.63	25.21	17.64	25.35

Source: [3] Tian, H., Wang, WR. Research on The Applicability of Stock Valuation Model. Cooperative Economy and Technology 06, 67-69 (2022).

This study uses the average PE of 5 companies with similar characteristics to the Poly Union Group Corporation as its PE (see Table 3).

Table 3. Earning per share of the Poly Union Group Corporation from 2017-2021

Year	2017	2018	2019	2020	2021
Earning per share	0.23	0.36	0.30	0.26	0.21

Source: <https://www.doc88.com/p-7495651190587.html> [8]

As shown in Table 3, the earning per share among the 5 years on average is $(0.23 + 0.36 + 0.30 + 0.26 + 0.21) \div 5 = 0.272$.

Thus, the stock price of Poly Union Group Corporation in 2021 is

$$25.35 \times 0.272 = 6.90$$

Also, the price of the Poly Union Group Corporation's stock in 2021 on average is 6.45 according to the www.10JQKA.COM.CN.

The error rate is

$$(6.90 - 6.45) \div 6.45 = 6.98\%$$

3.3. The comparison between the DDM and the PEG model

In this case, the error rate of the DDM model is negative while that of the PEG model is positive. Judging from the numbers, it is obvious that the amount of error in terms of PEG is smaller than that of DDM. Under this circumstance, the PEG model is undoubtedly more convincing while the DDM model does not work. From another side, the calculation of DDM is far more complicated than that of PEG. In general, the PEG model is an excellent improvement for the DDM model to some extent.

3.4. The suggestion to investors

This article does confirms that the PEG valuation method is indeed more accurate from the perspective of case analysis, but investors should not be too superstitious about the PEG, and it is unscientific to only use the PEG as the criterion for judging whether the company is worth investing [10].

4. Conclusion

The research finds out that the DDM model does not work when the growth rate of dividend outweighs the the rate of return and the PEG model is very suitable for stocks which has low return rate of dividend or no dividend. And when the PE is higher than 1, it means the stock of the entrepreneur is overestimated. Also, when the PE is lower than 1, the stock of the company is underestimated. Thus the PEG model is a very good alternative for the DDM model. Because the PEG model considers the growth of the company and the potential risk factor whereas the DDM model ignores them. It can compare valuation levels of different growth companies. Compared with

the DDM model, the PEG model is more reasonable for these startups. This study covers the gap between the DDM and its variations. It gives more access to valuing a company accurately. However, when the earning per share is negative, the stock price might be affected. Also, the PEG model does not consider the cash amount on the balance sheet. In addition, it is not appropriate for stocks with high dividends and is very sensitive to the choice of growth expectations. In the future, further refinement can be made on the above related operations to facilitate in-depth research on this topic. Something should be added to modify the PEG model. Furthermore, too many assumptions in the calculation during the research can also lead to more subjective factors, resulting in further bias in valuation. Finally, it is a pity that the systemic risk coefficient β during 2021-2023 cannot be found. So the calculated expected rate of return might not be accurate.

References

- [1] Michael G Millan. Investments. China Macnine Press, Beijing, 2015, 10, 4.
- [2] Poly Union Group Corporation. Retrieved from: <http://www.gzjiulian.com/gywm/index.htm>, 2023.8.20.
- [3] Tian H., Wang W R. Research on the Applicability of Stock Valuation Model. Cooperative Economy and Technology, 2022, 6: 67-69.
- [4] Zhang Y H. Modern Corporate Finance. Fudan University Press, Shanghai, 2002, 1.
- [5] Yang L R. Corporate Finance. Science Press, Beijing , 2013.
- [6] Cheng J H. Fundamentals of statistics. Beijing Institute of Technology Press, Beijing, 2013.
- [7] DOC88.com. About the meaning and use of geometric means. September 6, 2017. Retrieved from August 26,2023. Retrieved from <https://www.doc88.com/p-7495651190587.html>
- [8] www.10JQKA.COM.CN. 002037 Poly United historically issued dividends. April 30, 2022. Retrieved from August 26, 2023. Retrieved from http://data.10jqka.com.cn/financial/sgpx/#refCountId=data_55ebdbc3_648
- [9] Huasheng News. In 2023, the first savings bonds went on sale, and interest rates fell again.March 10,2023. Retrieved from August 26, 2023. news.voc.com.cn
- [10] Li W J, Zhang J., Liu, H. A Comparative Study of Stock Valuation Methods Based on Company H. China's collective economy 2020, 26: 81-82.