Proceedings of the 2nd International Conference on Financial Technology and Business Analysis
DOI: 10.54254/2754-1169/60/20231153

Investor Investment Strategy from Discounted Dividend Model Perspective

Chuhao Fu[1,a,*]

[1]*Department of Finance, Technical University of Ostrava, Studentská 1770/1, Ostrava, Czech Republic*
a. fuc0027@vsb.cz
**corresponding author*

Abstract: Stocks, as a security in economic life and widely chosen by investors. The decision-making process of whether to allocate capital to stocks or not necessitates the employment of analytical methodologies, prominently including the assessment. This study employed, the 2-stage Dividend Discount Model, a classic model in stock price evaluations. Mitsubishi Heavy Industries, Ltd. (MHI) was selected as an example, on the basis of fundamental financial data and fundamental market information, the case study will determine the intrinsic value of MHI's shares. The analysis proffers that MHI's stock exhibits an undervaluation, warranting investors to consider a strategic position of acquisition and retention until equity valuations converge or above the intrinsic worth. In addition, the study simultaneously discusses the issues that need to be taken into account when using the model and analyses the problems with the model itself. The research also emphasizes the need to consider these findings alongside other factors, and additional valuation models for more accurate investment decision-making.

Keywords: 2-stage Dividend Discount Model, intrinsic value, Capital Assets Pricing Model, Mitsubishi Heavy Industries, Ltd. (MHI)

1. Introduction

In the realm of daily investment activities, equities are a ubiquitous choice among investors, serving as fundamental instruments for capital deployment. In this context, astute investors employ diverse analytical methods and a plethora of information sources in a comprehensive manner to prognosticate stock price movements and judiciously select optimal investment opportunities.

The main goal of this study is to use Mitsubishi Heavy Industries, Ltd., a well-known Japanese heavy industry conglomerate, as a case study. It uses the two-stage Dividend Discount Model to calculate the intrinsic value of the company's stock and compares it to the current market price of Mitsubishi Heavy Industries stock. Subsequently, this analysis culminates in the provision of a cogent investment recommendation.

The dissertation is structured across four discernible sections. Chapter 2 represents the theoretical foundation, elucidating the underpinning theoretical framework, the assumptions intrinsic to the selected model, and comprehensive formulation details. Chapter 3, the problem-solving component, offers a comprehensive exposition of results derived through the methodologies delineated in Chapter 2. Chapter 4 serves as the forum for deliberation and elucidation, wherein the constraints inherent to

© 2023 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2754-1169/60/20231153

the 2-stage Dividend Discount Model are critically examined. Finally, Chapter 5 advances an investment strategy, leveraging the insights gleaned from Chapters 3 and 4.

2. Methodology

All of the models that will be utilized in this thesis are going to be covered in this chapter. It will be split into two halves. The Dividend Discount Model and 2-stage Dividend Discount Model are introduced in the first section, while the Capital Assets Pricing Model is covered in the second section.

2.1. Dividend Discount Model

A well-known method for determining a stock's intrinsic value is the Dividend Discount Model (DDM). The basic idea is based on the future dividends are converted to present value using a discount rate (when using this model, it is usually considered to use the cost of equity. (k_E)), and summed up the full discounted value can finally get the intrinsic value of the stock. [1] And the original equation of this model is as function (1). [2]

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k_E)^t} \tag{1}$$

P_0 represents the stock's intrinsic value, D_t represents the dividend for the specified time period (t), k_E is the required rate of return in the function (1).

The following presumptions are made while using this model. [3]

a. The company will always be healthy and growing.

b. The company always distributes dividends.

c. As a discount rate, the cost of equity is consistently constant.

d. Financial Market is efficient.

If, in the above hypothesis, it is assumed that the company's dividends will grow at a fixed rate of growth (g), function (1) will be rewritten as function (2), and the model will be referred to as Constant Dividend Discount Growth Model or Golden Model. [4]

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k_E)^t} = \sum_{t=1}^{\infty} \frac{D_1(1+g)^{t-1}}{(1+k_E)^t} = \frac{D_1}{k_E - g} \tag{2}$$

$$D_1 = D_0 * (1+g) \tag{3}$$

$$g = b * ROE = (1 - DPR) * ROE \tag{4}$$

In the function (2), D_1 is the first period dividend and g is the growth rate of dividend or earnings.

Function (3) and (4) introduce the method to get the first period dividend (D_1) and the growth rate (g) separately. D_0 in the function (3) means the initial dividend. And in the function (4), ROE means the return on equity, and the meaning of b is the retained earnings rate, or can be rewritten as the $(1 - DPR)$, and DPR means dividend payout ratio.

After using the model to determine the intrinsic value of the related company's shares, which can then be compared to the stock's market price to choose the appropriate investment strategy. It is generally divided into the following three cases: [5]

a. If the result is more than the market price, the company is undervalued at the moment and should be purchased by investors.

b. If the result and market price are same, it signifies that the stock price is now accurately representing the stock's intrinsic worth and that the investor should continue holding the shares.

DOI: 10.54254/2754-1169/60/20231153

c. If the result is less than the market price, this indicates that the stock is overvalued at the moment and that the investor should sell it.

2.2. 2-stage Dividend Discount Model

In using the DDM model, economists have proposed a 2-stage Dividend Discount Model based on improvements to the original model. The aim is to bring the results closer to reality. In the new model, it is assumed that the company has two development time periods, in the first-time period, the company out of the rapid development stage, the growth rate is faster, and after the development of the first period, the company gradually tends to mature, began to enter into a period of smooth development (second-time period). In this period, the growth rate decreases and it is assumed that company will always grow at that rate in the future. [6]

The core formulation is similar to the Dividend Discount Model, and the formula is shown below.

$$P_0 = \sum_{t=1}^{T} \frac{D_t}{(1+k_E)^t} + \frac{EPS_0(1+g)^T(P/E)}{(1+k_E)^T} \tag{5}$$

In the function, the accumulation indicates the first time period and the latter is the second time period. Some parameters in function (5) have the same meaning as function (2), so they are not explained here, for example, D_t, k_E and g. Compared to function (2), some new parameters appear in the new equation, where EPS_0 is an elliptical sense, unfolded as Earning Per Share, the P/E, which means the Price Earnings ratio. For the parameter calculations, where growth rate (g) can be carried out using function (4), and for discount rate (k_E), this thesis will use the Capital Assets Pricing Model (CAPM), which will be presented in the next section.

2.3. Capital Assets Pricing Model

This model is based on the Markowitz portfolio theory, was proposed by Treynor, Sharpe, Lintner, and Mossin in the early 1960s and has been developed and refined since then. [7]

The model will be based primarily on the following assumptions [8]:

a. All investors are the rational investors and they have homogenizing ideas about the securities.

b. Perfect competition market.

c. A risk-free rate exists for investors to liquidate their cash.

d. All investors have free and timely access to adequate market information.

e. No transaction cost.

In this model, beta coefficient (β) is referred to as the risk factor and is used to measure the risk of the asset. Moreover, the model introduces the concept of a market portfolio, which includes all securities in the market and investors will invest this portfolio.

The model equation is shown in function (5). [7]

$$E(r_i) = R_f + \beta_i * (R_M - R_f) \tag{6}$$

In this function, $E(r_i)$ is the expected return of the selected assets i, R_f is the risk-free rate, R_M is the expected return of market portfolio, $(R_M - R_f)$ can be seen as the risk premium and the β_i is the systematic risk for the selected assets i.

DOI: 10.54254/2754-1169/60/20231153

3. Result

In this chapter, all calculations will be given based on the formulas presented in Chapter 2, and will follow the order of the parameters in the formula in the order of ROE and g, k_E, and intrinsic value of the stock.

3.1. Basic Introduction

Mitsubishi Heavy Industries stands as one of Japan's most venerable and all-encompassing industrial manufacturers. Their scope spans a diverse array of sectors, including energy (energy-related products), aircraft, space, ships & ocean, transportation, automobiles, defense. Currently, their corporate stocks are listed on the Tokyo Stock Exchange and three other Japan's stock exchanges, with a stock code of 7011. [12]

Presently, as the impact of the epidemic on people's lives continues to recede, there are discernible signs of recovery in the global economy. Simultaneously, MHI's stock prices over the past decade reveals a clear upward trajectory, since 2022, indicating a general trend of sustained growth in the future. [12] However, in conjunction with the development of the industry in which the enterprise operates, the Japanese machinery industry in general is currently in the mature stage of the industry cycle. In such circumstances, absent substantial market expansion or groundbreaking technological advancement, the industry is likely to reenter a protracted period of stable operation following the post-pandemic era.

Taking these factors into account, this thesis employs a 2-stage Dividend Discount Model with the year 2027 serving as the node for analysis.

As per the financial data published on the official Mitsubishi Heavy Industries website, here are some key figures: Payout ratio (b) = 30%, DPS in 2022(D_0) = 55 yen. [12] And in conjunction with information from the Tokyo Stock Exchange, additional basic data are as follows: EPS in 2023(E_0) = 388.43 yen, Price Earnings Ratio (P/E) = 20.01, beta coefficient (β) = 0.7. [13]

3.2. Return on Equiy and Growth Rate

For ROE, this thesis will use the 5-year average ROE for calculation, and taking into account the effect of time, it will use the weighted average of 5-year ROE. The results are shown in Table 1.

Table 1: MHI's Return on Equity from 2018 to 2022 and the average Return on Equity (Unit: Millions Yen) [12].

	2018	2019	2020	2021	2022
EAT	137388	107284	43202	125654	146308
Equity	1728693	1290076	1439390	1662529	1833984
ROE	7.95%	8.32%	3.00%	7.56%	7.98%
Weight	0.05	0.05	0.2	0.3	0.4
Average ROE	6.87%				

In addition, chapter 3.1 mentions MHI's Payout ratio is 30%. Then, according to function (4) in Chapter 2, $g = 4.81\%$. (Function (7))

$$g = (1 - 30\%) * 6.87\% = 4.81\% \quad (7)$$

DOI: 10.54254/2754-1169/60/20231153

3.3. Required Rate of Return

In Chapter 2, this factor will be solved by using Capital Assets Pricing Model (CAPM). And in this thesis, the risk-free rate (R_f) will be used the Bank of Japan's benchmark discount rate, which is 0.3%.

For the market expected rate of return (R_m), this thesis will use the weighted average annual growth rate of the Nikkei 225 index. Table 2 shows the results of the R_m.

Table 2: Nikkei 225 Annual Average and Growth Rate from 2018 to 2022.

	2018	2019	2020	2021	2022
NIKKEI INDEX	22301.73	21697.23	22705.02	28836.54	27257.79
Growth rate		-0.02711	0.046448	0.270051	-0.05475
Weight		0.1	0.2	0.3	0.4
R_m	6.57%				

According to the basic data in chapter 3.1, beta coefficient (β) = 0.7.

Using the function (6) in Chapter 2, $k_E = 4.69\%$.

$$k_E = 0.3\% + 0.7 * (6.57\% - 0.3\%) = 4.69\%$$

3.4. Intrinsic Value

Combining the calculations from Chapter 3.2, 3.3 and using Chapter 2's function (5), the final result is shown in Table 3.

Table 3: MHI's stock intrinsic value (2-stage Dividend Discount Model).

	2023	2024	2025	2026	2027	2027→∞
Dividend	57.65	60.42	63.32	66.37	69.56	9830.61
Discount factor	1.05	1.10	1.15	1.20	1.26	1.26
Discount value	55.06	55.13	55.19	55.26	55.32	7817.76
Intrinsic Value	8093.72					

4. Discussion and Interpretation

This chapter will discuss some of the problems or limitations of the 2-stage Dividend Discount Model.

Firstly, as previously noted by Li J in his study, based on the present value of all future cash flows is an advantage of the model, but this also makes the model inapplicable to firms that do not offer cash dividends. [9] For example, when assessing the intrinsic value of a recently listed technology firm's stock, the Dividend Discount Model may prove inadequate since the company may choose not pay cash dividends for its own growth, but rather invest the profits in corporate reproduction or growth. Furthermore, in addition to paying cash dividends, firms can also choose alternative methods such as stock split, stock dividends and stock repurchase which would also make the Dividend Discount Model inappropriate for valuation purpose.

Secondly, it is worth noting that the Dividend Discount Model exhibits an extremely sensitive to changes in its parameters. The variations in dividends, growth rates, or discount rates can lead to substantial alterations in the final valuation outcome. Therefore, the accuracy of the parameters is the accuracy of the final result.

Thirdly, for the 2-stage Dividend Discount Model, another distinct challenge is the question of how to determine the time node of the 2 time periods. Typically, the division between the two stages

DOI: 10.54254/2754-1169/60/20231153

is a reasonable assumption based on a combination of realistic information, i.e., an artificial determination of time node. However, in real-world circumstances, the future situation may differ significantly from the expectations, which potentially resulting in significant disparities between the actual outcomes and the results predicted by the model. This, in turn, can impact, the accuracy of the final results.

Fourthly, as highlighted in the second point of this chapter, the sensitivity of the Dividend Discount Model requires that the parameters are sufficiently accurate in order to obtain correct results. In this thesis, using the Capital Assets Pricing Model to calculate the required rate of return's estimation, but the model itself also suffers from a number of problems, which may make the resulting factor insufficiently reflective of the truth. Specifically, there are several main issues of the Capital Assets Pricing Model.

a. The model's assumptions do not usually hold true in real life. (For example, perfect competitive markets, sufficient information, etc.)

b. There are different criteria for determining the risk-free rate. [10]

c. Only considering market risk, ignoring the effects of factors other than the market. [11]

5. Conclusion

The purpose of this thesis is to find the MHI's stock intrinsic value and observe its difference with market value. To achieve this, the study employs both the Dividend Discount Model and Capital Asset Pricing Model. Consequently, these two methods assume a pivotal role in the subsequent discussion, where their limitations are thoroughly examined and analyzed.

Based solely on the results calculated using the 2-stage Dividend Discount Model in Chapter 3, now (August 17, 2023), Mitsubishi Heavy Industries stock price is ¥7,367 per share [12], and the calculated intrinsic value is ¥8,093.72 per share. Followed the Methodology chapter, from this perspective, the investors should choose to increase the holdings of the stock and sell it when the price rises to near the intrinsic value in order to make a profit on the difference.

However, as mentioned in the discussion in Chapter 4, there are some limitations in the model. Therefore, when making investment decisions, it should be combined with other information simultaneously, such as using fundamental analysis, SWOT analysis so that to get the comprehensive understanding of the external and internal development environment of the enterprise, to make a certain assessment of the future development of the enterprise. At the same time, combined with other models to make the correct investment decision based on the synthesis of the calculation results of different models.

References

[1] *Vernimmen P, Quiry P, Le Fur Y. Corporate finance: theory and practice. 14th ed. John Wiley & Sons, 2022. ISBN: 978-1-118-84929-3*

[2] *Chen J, Wu Y, Xu Y. Research and analysis of asset pricing model based on the empirical test of stock price. International Conference on Economic Management and Cultural Industry, 3rd. (ICEMCI 2021). Atlantis Press, 2021: 1288-1293.*

[3] *Eddy S, Wawan S, Imam G. Determination of Intrinsic value: Dividend Discount Model and Discounted Cash Flow Methods in Indonesia Stock Exchange. International Journal of Management, 2020, 11(11).*

[4] *Dukalang H, Koni W, Mokoagow N C. Comparison of Dividend Discount Model With Free Cash Flow To Firms For Valuation of Banking Stocks Listed in Jakarta Islamic Index (JII) Period 2016-2020. IQTISHADUNA, 2021, 12(2): 278-285.*

[5] *Febriani D, Lupikawaty M, Hushori A, et al. Stock Price Valuation Using The Dividend Discount Model on IDX Mining Period 2011-2020. International Conference, 5th. (FIRST-T3 2021). Atlantis Press, 2022: 51-55.*

[6] *Xu J. Advantages and Disadvantages of Dividend Discount Model and Better Alternatives. International Conference on mathematical statistics and economic analysis (MSEA 2022). Atlantis Press, 2022: 456-461.*

[7] *Bodie Z, Kane A, Alan J. M. Essentials of investments. 15th ed. McGraw-Hill Irwin, 2020. ISBN: 978- 0072510773*

DOI: 10.54254/2754-1169/60/20231153

[8] *Peng S. The Validity of CAPM: A Critical and Conclusive Study with Empirical Evidence from the UK Security Market. International Conference on Economic Management and Cultural Industry, 2021 3rd. (ICEMCI 2021). Atlantis Press, 2021: 2237-2243.*

[9] *Li J. Valuation methods and the Risk Performance Analysis. 2020.*

[10] *Al Shaban R, Hamed F S M, Nobanee H. An Overview of the Capital Asset Pricing Model. 2020.*

[11] *Li Z. Analysis and Comparison of Capital Asset Pricing Model and Arbitrage Pricing Theory Model. International Conference on Economic Management and Cultural Industry (ICEMCI 2022), 2022 4th. Atlantis Press, 2022: 1899-1906.*

[12] *Mitsubishi Heavy Industries Stock Basic Information.Retrieved from: https://www.mhi.com/jp/finance/stock/status*

[13] *Tokyo Stock Exchange. Japan Exchange Group. (18 August, 2023). Retrieved from: https://quote.jpx.co.jp/jpx/template/quote.cgi?F=tmp%2Fstock_detail&QCODE=7011&MKTN=T&cht=21&mode=M#*