Using DDM and FCFF to Evaluate Stocks' Value: Take HP as an Example

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Abstract. With the fast development of the global economy, the investment market has become one of the most important markets in the world. Among various investment products, equity investment stands out because of its high profitability and risks. For investors who want to earn profits from the stocks, estimating the actual value of a company's shares and lowering the risk of uncertainty is necessary. This research presents two models to asses investors' target companies. To show the calculations, this research takes Hewlett-Packard as an example and collects data from related websites. The discounted dividend model assumes an indefinite term of the company's constantly growing dividend payment and discounts the predicted dividends to work out the present stock price. The free cash flow to firm model takes the data in the company's financial reports and estimates its growing free cash flow, which will be discounted to calculate its present value. The two models indicate that Hewlett-Packard's value is underestimated, suggesting investors take an optimistic attitude. The limitations of the models, such as strict assumptions and investors' subjectivity, should also be noted because they may make the results inadequate. Further research can be made to optimise the two evaluating models.

Keywords: Equity Investment; Discounted Dividend Model; Free Cash Flow to Firm Method.

1   Introduction

The evolution of economics stands out as a notable facet of the unfolding of time. The traditional notion that employment is an indispensable means of earning income has transformed contemporary society. This shift arises from recognising that an alternative avenue for income generation exists—from original savings and astute market analysis, a process commonly referred to as investing. Simultaneously, with the ongoing development of global economics, the investment market is experiencing an expansion in its scale. This interconnected progression underscores the dynamic relationship between economic evolution and individuals' strategies to secure financial well-being.

Since the advent of globalisation, the number of participants and the array of investment products have multiplied. Contemporary investors find themselves navigating the expansive global market replete with a diverse range of investment opportunities.

Among these, equity investment emerges as a distinctive and specialised form of investment. Its universal appeal lies in the potential for high returns and elevated risk, setting it apart from lower-risk investment avenues like bonds and commercial notes. Equity financing involves a company divesting a portion of its ownership to raise capital by issuing shares. This strategic move simultaneously expands the company's shareholder base and attracts investments. When companies lack capital, they select equity financing as the first choice because there is no need to pay back principal and interest compared to bank loans [1]. Equity investment entails investors purchasing shares in the stock market, offering a choice between acquiring specific company shares or diverse portfolios encompassing various stocks and investment products. Profits from equity investment typically emanate from two sources—the first being dividends distributed by companies to shareholders based on their dividend policy. The second source for investors' earnings is capital gains, realised when stocks are sold at prices higher than their original purchase cost.

The dynamic fluctuations in a firm's stock prices significantly contribute to the risk associated with equity investment, where an investor's capital has the potential to yield profits one day and incur losses the next. This volatility underscores the intricate landscape that modern investors must navigate in pursuing financial growth. Nevertheless, a risk premium indicates that most investors lean towards risk aversion. A predilection for low risk is a prevalent criterion among investors, with some willing to sacrifice a small proportion of profits to ensure the safety of their investments. Given the widespread use of equity investment and the vast scale of the stock market, addressing the challenge of mitigating the high risk of stocks while ensuring sufficient profits is a paramount question for investors and investing agencies.

Before committing funds, a pivotal step in investment involves meticulously evaluating a stock from various relevant perspectives. This process, coupled with a comprehensive understanding of the company's value and discerning disparities between results and market prices, empowers investors to make informed investment decisions. Consequently, this research aims to present mathematical methods for assessing whether a firm's share price is overvalued by calculating the actual value of the target company for investors. The methods explored in this study include the Discounted dividend method (hereafter DDM) and the Free cash flow method (hereafter FCFF). Utilising the evaluation methods provided by this research, investors can scientifically assess the value of a company and compare it with its stock price. This analytical framework constitutes a crucial component of an investor's analysis, facilitating the formulation more prudent and well-informed investment decisions. This research is poised to contribute to investors' decision-making processes by furnishing them with valuable tools to evaluate a firm's share price. By offering these tools, the research aims to assist investors in avoiding investments in overvalued shares and preventing missed opportunities with undervalued assets. These tools are anticipated to enhance the precision and effectiveness of investment decisions, providing investors with a more informed and strategic approach to navigating the dynamic landscape of financial markets.

2   Methodology

2.1   Methods

The methods of evaluating a company's value introduced by this research are DDM and FCFF.

Discounted Dividend Method.

The discounted dividend method, introduced by John Bol in 1938 within the "Value Investment Theory" book, assesses the present value of stocks from the investors' standpoint. This model operates on several core assumptions which serve the idea that the intrinsic value of stocks comes from the total present value of every future period's dividend payment [2]. Firstly, it assumes a stable growth rate for the dividends of the target company. Secondly, it posits that the aim company will consistently distribute dividends to shareholders indefinitely. Thirdly, the profits derived from holding these stocks are exclusively from dividends.

Based on these assumptions, the model computes the calculation of the present-day (T_0) stock price of a company (Equation (1)).

$$Evaluated\ Stock\ Price = \frac{Dividends\ payment\ in\ T_0 * (1 + Growth\ Rate\ of\ dividends(g))}{(Cost\ of\ Equity - g)} \tag{1}$$

It is crucial to note that in these calculations, the discount rate should consistently exceed the growth rate of dividends. While the DDM is clear and straightforward, its applicability is sometimes hindered by the stringent nature of these assumptions. Key challenges include the difficulty of ensuring a constant growth rate of dividends and the impracticality of firms paying dividends indefinitely. Despite these challenges, DDM still significantly influences the history of estimating stock value, and models like the Gordon and Walter models have been derived from DDM after improvements [3].

Free Cash Flow to Firm Method.

In addition to the DDM, the model's evaluation incorporates the calculation of free cash flow, an alternative to equity-based assessments.

Alfred Rappaport introduced the FCFF in the twentieth century. Free cash flow represents a company's earnings that are available for contribution after meeting reinvestment needs, ensuring ongoing development. Like DDM, FCFF is also a model of income approach when valuing a firm, emphasising the firm as an asset and calculating its present value through the estimated future earnings [4]. The formula for calculating a specific year's free cash flow is in equation (2).

$$Free\ Cash\ Flow = EBIT - Tax + Depreciation - Change\ of\ Working\ Capital - Capital\ Expenditure \tag{2}$$

Employing the Weighted Average Cost of Capital (hereafter WACC) as the discount rate, the company's total value can be computed based on the historical free cash flows. When comparing stock prices, the calculated P0 involves subtracting the company's liabilities from its value and dividing the result by the number of outstanding shares. This approach provides an alternative perspective for investors, incorporating free cash flow dynamics. When using FCFF, investors need to use data from the financial reports of the target company, which involves different related indexes, and the result offers a comprehensive evaluation beyond traditional equity-focused methods like DDM [5].

2.2   Sample

This research has selected Hewlett Packard (HP) as a case study to analyse its value and compare it with its market share price, utilising the methods introduced earlier.

Hewlett-Packard is an American information technology company with a foundation dating back to 1939. The company comprises three key business groups: the Information Products Group, the Printing and Imaging System Group, and the Enterprise Computer Professional Service Group. HP's product portfolio includes computers, tablets, accessories, printers, display screens, scanners, and consumables. Targeting a diverse audience, HP caters to companies of varying scales, individual consumers, and technology institutions. However, the company's financial performance in recent periods, as indicated by its 2023 third-quarter report with revenue at 13.2 billion dollars, has fallen short of expectations. Possible analysed reasons include persistent macroeconomic headwinds and inflationary pressure [6].

The data on HP used in this research includes its dividend payment (2016-2024) from Sina Finance and the information on HP's financial reports (2019-2023) from Sina Finance, Nasdaq and Macrotrends. Other information on HP's cost of equity and WACC comes from ValueInvesting.io.

3   Analysis and Discussion

3.1   DDM

This research will start with the DDM to evaluate the value of HP. According to equation (1), the data needed is the growth rate of HP's dividend, equity cost, and the stock price in T_0.

Table 1. Dividend payment of HP from 2016-2024

Year	Dividend payment	The growth rate of each year
2016	0.5047	
2017	0.5374	6.48%
2018	0.5781	7.57%
2019	0.6568	13.61%
2020	0.7224	9.99%
2021	0.8314	15.09%
2022	1.0125	21.78%
2023	1.0631	5.00%
2024	1.1024	3.70%

Source: Sina Finance

According to the data from Table 1 [7], apart from several peaks and bottoms, the growth rate of dividend payments from 2016 to 2024 is relatively steady in the range. Because of that, the g of HP can be regarded as a stable figure, and this research picked 9.50% to be used. The r in equation (1) is HP's equity cost. According to ValueInvesting.io, the figure ranges from 9.10% to 11.80%, and the chosen number is 11.00%. Then, bring in the figures; the formula is as follows:

$$DDM = 1.1024 * \frac{(1+9.50\%)}{(11.00\%-9.50\%)} = 80.48 \tag{3}$$

The estimated value is 80.48 USD in equation (3), which is higher than HP's present stock price of 29.41 USD. The DDM model says that HP's value in the stock market is undervalued, and the actual stock price should be higher than 29.41 USD.

One reason for this result may come from the dividend payout ratio. The dividend payout ratio can be worked out using the following equations (3) and (4).

$$EPS = \frac{Earnings\ of\ a\ year}{Number\ of\ shares\ of\ the\ same\ year} \tag{4}$$

$$Dividends\ payout\ ratio = \frac{Dividends\ per\ share}{EPS} \tag{5}$$

Table 2. Calculation of dividends payout ratio from 2020-2023 (in USD thousands)

	2023	2022	2021	2020
Earnings of each year	3,263	3,132	6,541	2,815
Number of shares	990	1,080	1,290	1,450
EPS	3.30	2.90	5.07	1.94
Dividends per share	1.10	1.06	1.01	0.83
Dividend payout ratio	0.33	0.37	0.20	0.43

Source: Nasdaq and Companies Market Cap

The data of Table 2 [8] shows that the dividend payout ratio of HP in the past four years is relatively small. This means that dividend payment only occupies a small proportion of HP's earnings. The number of dividends cannot fully represent HP's financial condition and the company's ability to develop continuously in the future.

Besides the reason presented by the dividend payout ratio, the influence can also come from the assumptions of DDM introduced in the methodology. In the actual market situation, whether the company's dividend payments will grow indefinitely is challenging to predict, and it is hard to ensure that the growth rate is stable in a small range. The cost of equity (r) in equation (1) is also floating and may derive error. Despite the deficiency mentioned, the result of DDM still provides an optimistic tendency to investors who emphasise dividends. The investors whose proportion of dividend payment in their profits is high can also consider DDM's calculation.

3.2   FCFF

When estimating the value of HP, the first step of using FCFF is to calculate the firm's free cash flow in past years according to equation (2). The working capital change can be solved in this process as equation (6) and the data in Table 3 [9].

$$Working\ capital\ change = \ Current\ asset -$$
$$Current\ liability\ of\ the\ same\ year \tag{6}$$

Table 3. Calculation of the change of working capital (in USD millions)

Year	2023	2022	2021	2020	2019
Current asset	17,977	19,736	22,168	20,648	20,177
Current Liability	24,488	26,189	29,061	26,220	25,293
Difference	-6,511	-6,453	-6,893	-5,572	-5,116
The change in working capital	-58	440	-1,321	-456	

Source: Sina Finance and Macrotrends

Table 4. Calculation of free cash flows and its growth rate from 2020-2023 (in USD millions)

Year	2023	2022	2021	2020
EBIT	2,937	4,324	7,568	3,211
Income tax	-326	1,192	1,027	396
Depreciation	850	780	785	789
Working capital change	-58	440	-1,321	-456
Capital expenditure	-609	-791	-582	-580
Free cash flow	4,780	4,263	9,229	4,640
Growth rate of free cash flow	0.1213	-0.5381	0.9890	

Source: Nasdaq

When using the free cash flow data from Table 4 [10] to calculate the whole value of a company, it shares the same primary mathematical method as DDM in the following equation (7).

$$Total\ value = Free\ cash\ flow\ of\ T_0 * \frac{(1+g)}{(r-g)} \tag{7}$$

The r in this model is the weighted average cost of HP's capital. According to Value-Investing.io, the picked number is 9.90%. Bringing the numbers together, the formula shows that the total present value of HP is 114611363.6 thousand USD. When finding out whether HP is undervalued or overvalued, this result of FCFF here is clear but not straightforward enough. Considering that the share price is the most commonly used index to present a firm's value, the figure above needs to be transformed to share price. Equation (8) shows how to work the present share price under FCFF; the result is USD 77.31.

$$Share\ price\ of\ HP = \frac{(The\ calculated\ value - Present\ liaility)}{Number\ of\ shares\ outstanding} =$$
$$\frac{(114,611,363,600 - 38,073,000,000)}{990,000,000} = 77.31 \tag{8}$$

As 77.31 USD is higher than the market price of 29.41 USD, FCFF shows that HP's stocks are undervalued. This result is based on calculating the free cash flow, which is more reliable than DDM, which is based on dividends because free cash flow reflects the foundation of a company's value. However, FFCF can also involve error. On the side of firms, its free cash flow may be manipulated purposefully and lose its data's facticity. On the investors' side, the selection of WACC and the growth rate of free cash flow will also influence the final result.

3.3   Investment Suggestion

The estimations of DDM and FCFF both reveal that the value of HP in the investment market is undervalued, and the evaluation of DDM is slightly higher than that of FCFF. That means HP's stock price is likely to rise, indicating a growing prediction of HP's management and development. For investors who place a higher value on dividend payments, the result of DDM is more suitable, but they should also notice HP's small dividend payout ratio. Investors who may be more concerned about their stocks' capital growth can pay more attention to FCFF's calculation.

Overall, taking these two models into account, generally, shareholders should buy HP's stocks or hold the HP stocks that they already have.

4   Conclusion

This research provides two income-based approaches to help investors evaluate a certain company's value. It also uses HP as an example to present the total process. The DDM uses the company's history of dividend payments to calculate the discounted future dividends; the result is 80.48 USD, which tells investors that HP is undervalued. The FCFF considers the company's free cash flow and discounts the predicted future free cash flow to work out the company's present value. FCFF's estimation of HP is 77.31 USD, indicating that HP's real value is higher than the market price. The investment suggestion given by the two models is to hold or buy HP's stock. Investors can estimate their target firm's value but must be familiar with the features and limitations of DDM and FCFF to decide their weight in their consideration. This research mainly focused on the usage of DDM and FCFF, while future research can be conducted to investigate the improvements of these two models, which may provide a more adequate and reliable evaluation to investors.

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