Corporate Finance - Coursework Task I

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Contents

Nomenclature

τ_c Corporate Tax Rate;

$EBIT$ Earnings Before Interest and Tax;

EV Enterprise Value;

FCF Free Cash Flow;

g_{FCF} Long-run Free Cash Flow Growth Rate;

P_0 Present Price;

r_D Cost of Debt;

r_E Cost of Equity;

r_{wacc} Weighted Average Cost of Capital;

TV Terminal Value;

1. Introduction - DCF Model

1.1 Description

The discounted cash flow model is an indirect model used to value a whole firm or enterprise based on future cash flows. The model initiates by determining the enterprise value (EV) of the firm to both equity and debt holders. This value is defined as the firm's underlying business, free of financial liabilities, and is separated from any cash or marketable securities. After estimating the EV, a deduction of the market value of the firm's financial liabilities is made in order to determine the share price. As this is done after, it is labelled as an indirect method. The method used to calculate the DCF value of the firm is given in appendix A.

1.2 Strengths and Weaknesses

For the purpose of this valuation we are using the DCF model, however, in the end, no single technique presents an answer for the stock's true value. Although the DCF requires a lot of detail to estimate the intrinsic value of the stock, it nevertheless remains popular to financial analysts, if they're confident about future assumptions. These assumptions or forecasts can be too uncertain to provide a conclusive expectation of the firm's value, i.e. an unpredicted scenario. Often analysts will use a combination of the DCF and other models, such as DDM and Multiples in order to build confidence in their valuation, assuming these alternatives are consistent [1]. The DCF relies on cash flows, which analysts estimate from the income statement and balance sheet and start with the 'earnings before interest and tax' (EBIT) accounting for the business' re-investment. These include future inflows and outflows of the firm's funds. The result of estimates based on projected cash flows eradicate subjective accounting policies in report earnings and contribute to a more realistic value of a company or index [2]. However, this may also be a limitation in the application of FCFs that are not done properly, and the predictions are off. The investor must make several assumptions to complete this analysis, i.e. add an expected growth rate. What is the right discount rate [3]? Various analysts can

select different inputs for these values resulting in potentially widely varying figures. Hence, analysis is best thought over a range of values derived from different analysts using these varying inputs. Multiples and relative valuation are easier to calculate than the DCF so why not use this method? Their accuracy is ambiguous if dealing with a sector or market that is over or under valued. DCF, doesn't rely on such a predicament and thus, estimates the best possible intrinsic value. Nonetheless, the DCF is still thought of as a simple and fast method of valuation, compared to assessing the value by neglecting cash flows from debt, interest and liabilities [4]. Most importantly, the DCF can determine if the index's or company's stock is over valued or under valued and justified. This works by plugging in the current share price of the index or company and then working backwards. The major disadvantage of the DCF is that it is very sensitive to changes in the assumptions. Minor variations in the assumptions made, such as growth rate can have significant impacts on the valuation. As well as this, the valuation is always changing due to the volatility of the market; investor opinion and hence, the fair value (FV) changes accordingly to these modifications [4]. Thus, it is not an appropriate tool for evaluating short-term potential, and better for medium-term (2-3 years) and long-term (3+ years) profit potential.

1.3 Assumptions

The main assumptions of the DCF model used in our calculations are that the growth rate, WACC values and the forecasted cash flow values are accurate. This model uses the average growth rate of the free cash flow to forecast future free cash flows however, this assumption is unrealistic. The DCF model used outputs a value of $3,706 per share compared to the actual value per share of $3,331 [5]. As you can see from table B.1 & B.2, the growth rates fluctuate a lot throughout the years, varying from 27.8% in 2018 and -15.8% in 2019, making it extremely difficult to predict data for the upcoming years. These large uncertainties in the predicted values are further amplified due to the model's high sensitivity to the growth rate and WACC value. For example, if we use a WACC value of 9% compared to the 8.5% used in our model, the predicted value per share would drop from $3,706 to $3,294. This 0.5% difference in our WACC will decrease the value per share by over 10%, changing our evaluation of the S&P 500 index to go from being highly undervalued to slightly overvalued.

2. Price to Earnings

Using the price to earnings ratio as an alternative analytical technique to determine the value of the S&P 500, shows that the index is currently highly overvalued. This is because the PE ratio of the S&P 500 is currently high with a value of 25.43 [6], and it has only been above this three times in the past 100 years, shown in graph C.1 attached in appendix C: It averaged 70.91 in 2009, 46.17 in 2003 and 32.92 in 1999 [6]. This contradicts what was found using the DCF model which concluded that the index is currently undervalued. Although using the PE has assumptions regarding growth, margins and cost of capital, cross checking with other multiples has also shown that the index is currently overvalued. For example, using the price to book value shows that the S&P 500 is overvalued as it is currently at a value of 3.74 and has not been this high since 2002, shown in graph C.2 [7]. This correlates with PE, further suggesting the S&P 500 is overvalued, despite what the DCF model and calculations have shown.

3. Evaluation

The DCF is used in many cases due to its ability to measure the value of a business accurately. It is the most broadly used technique, often by investment bankers and academics. However, as mentioned in the weaknesses, companies act in a dynamic environment, and the method is therefore very sensitive to assumptions made in the market. If one key assumption is off to a large extent, the model can lead to a remarkably different valuation. For an analyst or potential investor, it is imperative that a model can be built to account for these price fluctuations when contemplating an investment. When dealing with a market index, such as the S&P 500, the effect is much the same, however, not to the same degree as individual securities. The large fluctuations due to the assumptions made using the DCF model prompt investors to pursue techniques such as sensitivity analysis to evaluate proposals and investments to a greater degree. When firms are not 100 % equity financed, one must adjust for the free cash flows to take account of tax exemption. When calculating the FCFs for a constituent firm of an index, one wants to keep them independent of the financing of the business, and thus use the weighted average cost of capital (WACC) for forecasting growth.

4. Future Outlook

As is to be expected with stock market valuations, the outcome is very dependent on large macro-economic trends and events. The current economic landscape is charactarised by persistently low interest rates which has inflated the value of indices, including the S&P500. The future performance of the S&P will be highly dependent on the policy of the Federal Reserve going forward. In addition to the actions of Jerome Powell, those of the American voters will also have a huge impact. Success of the stock market over the past 4 years has been in large part down to the 'Trump Bump' which saw the Republican President cut corporate tax rates and put pressure on the Fed to keep interest rates low. Trump is currently looking set to win a second term, with betting markets giving him implied odds of around 60% [8]. A strong economy will likely galvanise the voters to vote for the Trump they know, rather than the unknown quantity of likely Democratic nominee Bernie Sanders. This in turn will likely result in continued performance of this, the longest bull market in living memory.

5. Conclusions

The current value of the S&P index is $3,370, however using the DCF technique, a value of $3,706 is obtained, which suggests that the current estimate is undervalued. However, the price to earnings ratio of the index suggests that it is highly overvalued, and a similar conclusion is obtained from the price to book ratio. The assumptions used for the DCF valuation may be a large factor for why such a large variation in estimates exists, and as a result the DCF technique is not the most accurate method to use. A more accurate estimate may be obtained by comparing the assumptions that are used in the DCF model with those made by other investors, although the variability is inevitable.

6. References

[1] J. Birk and P. De Marzo. *Corporate Finance. Fifth, global edition*. Harlow, England: Pearson, 2020. ISBN 9781292304151.

[2] S.V. Begovic, M. Momcilovic, and S. Jovin. Advantages and limitations of the discounted cash flow to a firm valuation. *Škola Biznisa*, 1(1):38–47, 2013.

[3] J. Chen. Discounted cash flow, investopedia, 2019. URL https://www.investopedia.com/terms/d/dcf.asp.

[4] E. Stephen. Discounted cash flow business valuation: Advantages and pitfalls, 2019. URL https://www.firmex.com/resources/blog/discounted-cash-flow-valuation-advantages-pitfalls/.

[5] Yahoo Finance. S&P 500 quote and chart. URL https://uk.finance.yahoo.com/quote/%5Egspc?ltr=1.

[6] S&P 500 PE ratio, 2020. URL https://www.multpl.com/s-p-500-pe-ratio.

[7] S&P 500 Price to Book value, 2020. URL https://www.multpl.com/s-p-500-price-to-book.

[8] Betfair. USA - Presidential Election 2020 - next president. URL https://www.betfair.com/exchange/plus/politics/market/1.128151441.

[9] Bloomberg. Financial analysis statement, 2020.

[10] M. Zenner, E. Junek, and R. Chivukula. Bridging the gap between interest rates and investments, 2014. URL https://www.jpmorgan.com/jpmpdf/1320693985317.pdf.

[11] macroaxis. SP500 shares outstanding, 2020. URL https://www.macroaxis.com/invest/ratio/%5EGSPC--Shares_Outstanding.

A. DCF Calculation

To calculate the firm's enterprise value, the present free cash flow (FCF) must be determined. This is defined as capital that the firm has available to pay all investors, both debt and equity holders, and is given in equation A.1.

$$FCF = EBIT \times (1-\tau_c) + Depreciation - CapitalExpenditures - Increaseinnetworkingcapital \tag{A.1}$$

Net investment is capital expenditure in excess of depreciation intended to support the firm's growth beyond the level needed to maintain the firm's existing capital and can be substituted into equation A.1 above to give equation A.3.

$$NetInvestment = CapitalExpenditures - Depreciation \tag{A.2}$$

$$FCF = EBIT \times (1 - \tau_c) - NetInvestment - Increaseinnetworkingcapital \tag{A.3}$$

The two main sources a company has to raise money are equity and debt. In the DCF model the free cash flow paid to both the dept and equity holders are discounted by the weighted cost of capital (WACC) denoted as r_{wacc}. as opposed to other models such as the dividend discount model which uses the discounted rate to just equity holders. WACC is the average cost of capital the firm must pay to all of its investors, both dept and equity holders given in Equation 5. If a firm has no debt $r_{wacc} = r_E$ where r_E is the equity cost of capital.

$$r_{wacc} = \frac{EV}{EV + debt} \times r_E + \frac{debt}{EV + debt} \times r_D + (1 - \tau_c) \tag{A.4}$$

Using the weighted cost of capital as above and estimations for future cash flows, the enterprise value can be calculated shown in the equation A.5.

$$EV = \frac{FCF_1}{(1 + r_{wacc})} + \frac{FCF_2}{(1 + r_{wacc})^2} + \ldots + \frac{FCF_n}{(1 + r_{wacc})^n} + \frac{TV}{(1 + r_{wacc})^n} \tag{A.5}$$

TV is the terminal value in year n, as projecting into the future cannot be done perpetually. The terminal value is estimated assuming a constant long run growth rate for free cash flows after n years. This growth rate is based on the observed and expected growth rate based on revenues and is calculated in equation A.6.

$$TV = \frac{FCF_n(1 + g_{FCF})}{r_{wacc} - g_{FCF}} \tag{A.6}$$

In the DCF model interest income and expenses are ignored as the FCF calculation is

based on the earnings before interest and taxes (EBIT) value. However, cash and dept can be corrected for when calculating the share price using equation A.7 giving the share price.

$$P_0 = \frac{EV + Cash_0 - Debt_0}{SharesOutstanding_0} \tag{A.7}$$

B. Tables

Table B.1: Calculations for Forecasting Free Cash Flows [9];

Dates	FCF per share	FCF	Growth	Discount Rate	Price Value
2013	130.17	65345.34			
2014	111.17	55807.34	-14.60%		
2015	114.44	57448.88	2.94%		
2016	111.72	56083.44	-2.38%		
2017	115.71	58086.42	3.57%		
2018	147.91	74250.82	27.83%		
2019	124.55	62524.10	-15.79%		
2020 (estimate)	143.82	72197.64	15.47%	92.17%	66541.60
2021 (estimate)	170.05	85365.10	18.24%	84.95%	72513.84
2022 (estimate)	177.55	89130.17	4.41%	78.29%	69780.73
2023 (estimate)	185.38	93061.29	4.41%	72.16%	67150.64
2024 (estimate)	193.56	97165.80	4.41%	66.50%	64619.67
Terminal Value	4941.84	2480803.34		61.29%	1520596.23
NPV =					1861202.70

Table B.2: Valuation of S&P 500;

Number of Stocks	502
Average Growth	4.41%
Capital Cost (rwacc) [10]	8.50%
Enterprise Value	1861203
Net Debt	502.35
Value of Equity	1860700.35
Shares Outstanding [11]	502
Value Per Share	3706.57
Share Price [5]	3331

C. Graphs

Figure C.1: Graph showing the price to earnings ratios of the S&P 500 index over the past 150 years [6];

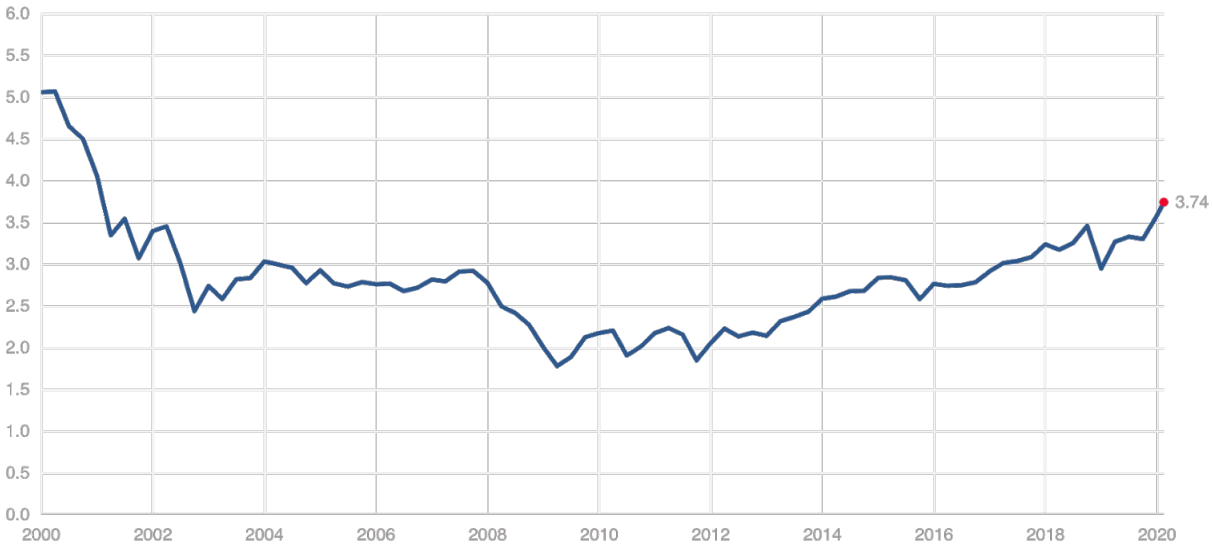

Figure C.2: Graph of the price to book values of the S&P 500 index over the past 20 years [7];