**DISCOUNTED CASH FLOW MODEL**

**I). INTRODUCTION**

**A. Understanding Intrinsic Value**

Intrinsic value is the perceived or calculated true value of an asset, investment, or company, based on fundamental analysis. This value is determined by examining various qualitative and quantitative factors, including financial statements, business models, competitive advantages, and future earnings potential. Intrinsic value is independent of the asset’s market price and focuses on its inherent worth.

Calculating the intrinsic value helps investors:

* Identify undervalued or overvalued stocks, providing opportunities for buying or selling.
* Make informed decisions based on the fundamental strength of the company rather than market trends or speculation.
* Develop a long-term investment strategy focused on value rather than short-term gains.

**B. Overview of the Discounted Cash Flow (DCF) Model**

The Discounted Cash Flow (DCF) model is a fundamental valuation method used to estimate the intrinsic value of an investment based on its expected future cash flows. These cash flows are projected into the future and then discounted back to their present value using an appropriate discount rate. The sum of these discounted cash flows represents the intrinsic value of the stock.

The DCF model is grounded in the principle that a dollar today is worth more than a dollar in the future due to the time value of money. This approach is widely used in finance because it focuses on the fundamentals of the business, rather than market sentiments or external factors.

**C. Importance of the DCF Model in Intrinsic Value Calculation**

The DCF model is particularly useful because:

* It provides a thorough analysis based on the company’s financial performance and potential growth.
* It considers the time value of money, offering a realistic valuation based on future cash flows.
* It helps in assessing the impact of different growth rates and discount rates on the value of the company.

By determining the intrinsic value of a stock using the DCF model, investors can:

* Identify undervalued stocks, which can be potential investment opportunities.
* Avoid overpaying for stocks that are overvalued by the market.
* Base their investment choices on the fundamental financial health and future prospects of a company.
* Reduce the impact of market volatility and speculative trading on their investment portfolio.

**II. Understanding Free Cash Flow (FCF)**

**A. Definition of Free Cash Flow**

Free Cash Flow (FCF) represents the cash generated by a company that is available for distribution among its security holders. It is a crucial measure of financial performance because it shows the amount of cash a company is able to generate after spending the money required to maintain or expand its asset base. FCF is important because it allows a company to pursue opportunities that enhance shareholder value, such as acquisitions, paying dividends, and reducing debt.

**B. Importance of Free Cash Flow in Valuation**

Free Cash Flow is a key indicator of a company’s financial health and its ability to generate cash from operations. It is used in various financial analyses and models, including the DCF model, because:

* It provides a clearer picture of a company’s operational efficiency and profitability.
* It highlights the company’s ability to generate cash, which is essential for funding operations, paying dividends, and investing in growth.
* It helps in assessing the company’s liquidity and financial flexibility.
* Investors and analysts use FCF to evaluate the potential for future growth and to make comparisons with other companies.

**C. Steps to Calculate Free Cash Flow from Financial Statements**

Free Cash Flow can be calculated using information from a company’s financial statements, specifically the cash flow statement and income statement. The general formula for calculating FCF is:

\text{Free Cash Flow (FCF)} = \text{Cash Flow from Operations} - \text{Capital Expenditures}

**1. Cash Flow from Operations**

Cash Flow from Operations (CFO) is the first section of the cash flow statement and indicates the cash generated from the company’s core business operations. It adjusts net income for changes in working capital and non-cash expenses, such as depreciation and amortization.

**2. Capital Expenditures**

Capital Expenditures (CapEx) represent the funds used by a company to acquire, upgrade, and maintain physical assets such as property, buildings, or equipment. CapEx is found in the investing activities section of the cash flow statement.

**III. Projecting Future Free Cash Flows**

**A. Historical Analysis**

Projecting future free cash flows begins with a thorough analysis of historical financial performance. By examining past financial statements, you can identify trends and patterns that may continue into the future. Key historical data to consider includes:

* Revenue growth rates
* Profit margins
* Historical free cash flow figures
* Capital expenditures
* Changes in working capital

Analyzing historical performance provides a foundation for making informed assumptions about future growth rates and expenses.

**B. Growth Rate Estimation**

The growth rate estimation is a critical step in projecting future free cash flows. It involves determining how quickly a company’s free cash flows are expected to grow in the future. Growth rates can be estimated using various methods:

* Historical Growth Rates: Calculate the average growth rate of free cash flows over a significant period (e.g., 3-5 years). This can provide a reasonable basis for projecting future growth.
* Analyst Estimates: Use growth rate forecasts provided by financial analysts. These estimates can be found in analyst reports or financial databases.
* Company Guidance: Consider growth projections provided by the company’s management in earnings calls, annual reports, or investor presentations.

When estimating growth rates, it’s important to account for factors such as industry trends, economic conditions, and company-specific developments.

**C. Forecasting Future Free Cash Flows**

With the growth rate established, you can project future free cash flows over a specified forecast period (typically 5-10 years). The formula for projecting future free cash flows is:

\text{FCF}{\text{future}} = \text{FCF}{\text{current}} \times (1 + g)^n

Where:

* \text{FCF}\_{\text{future}} = Future Free Cash Flow
* \text{FCF}\_{\text{current}} = Current Free Cash Flow
* g = Growth rate
* n = Number of years into the future

**IV. Estimating the Discount Rate (WACC)**

**A. Definition of the Discount Rate**

The discount rate is the interest rate used to convert future cash flows into their present value. It reflects the time value of money, accounting for the risk and opportunity cost associated with investing in a particular asset. In the context of the DCF model, the discount rate serves as a critical factor in determining the present value of expected future cash flows, which ultimately helps in calculating the intrinsic value of an investment.

**B. Use of the Discount Rate in the DCF Model**

In the DCF model, the discount rate is used to discount future free cash flows back to their present value. This process ensures that the valuation accounts for the risk and return expectations of the investment. The chosen discount rate directly affects the present value calculations; a higher discount rate results in a lower present value of future cash flows, and vice versa. Thus, selecting an appropriate discount rate is crucial for an accurate valuation.

**C. Why WACC is Used as the Discount Rate**

The Weighted Average Cost of Capital (WACC) is often used as the discount rate in the DCF model because it represents the average rate of return required by all of a company’s investors (both equity and debt holders). WACC considers the cost of equity and the cost of debt, weighted by their respective proportions in the company’s capital structure. It reflects the overall risk of the company and provides a comprehensive measure for discounting future cash flows. Using WACC as the discount rate ensures that the valuation incorporates the required return for both equity and debt investors, providing a balanced and realistic assessment of the company’s value.

**D. Components of WACC**

The WACC is calculated using the following formula:

WACC = (E / V) \* Re + ((D / V) \* Rd \* (1 - Tax Rate)

Where:

* E = Market value of equity
* D = Market value of debt
* V = Total market value of the company’s financing (equity + debt)
* ( Re ) = Cost of equity
* ( Rd ) = Cost of debt
* Tax Rate = Corporate tax rate

**1. Market Value of Equity (E)**

The market value of equity, often referred to as market capitalization, represents the total value of a company’s equity as perceived by investors in the market. It is calculated by multiplying the current stock price by the number of outstanding shares. The market value of equity reflects the collective expectations of investors regarding the company’s future earnings potential and growth prospects.

Market Value of Equity = Stock Price × Number of Shares Outstanding

**i. Stock Price**

The current trading price of one share of the company's stock (here closing price of the stock) which can be obtained from financial data providers such as yfinance.

**ii. Number of Shares Outstanding**

The total number of shares that have been issued by the company and are currently held by shareholders, including restricted shares owned by the company’s insiders and institutional investors. It can be obtained from the balance sheet of the company’s financial statements.

**2. Market Value of Debt (D)**

The market value of debt represents the total value of a company's outstanding debt, typically measured at current market prices. It may be estimated using the Long Term Debt from the balance sheet if market values are not readily available. The market value of debt includes bonds, loans, and other forms of debt obligations. It reflects the amount investors are willing to pay to hold the company’s debt instruments, considering factors such as interest rates, credit risk, and maturity.

##### **3. Total Market Value of the Company’s Financing (V)**

The total market value of the company's financing is the sum of the market value of equity and the market value of debt:

V = E + D

This represents the total value of the company's capital structure, encompassing both equity and debt financing. It provides a comprehensive view of the company’s funding sources.

**4. Cost of Equity (Re)**

The cost of equity represents the return required by equity investors to compensate for the risk of investing in the company. It is typically estimated using the Capital Asset Pricing Model (CAPM). It can be calculated using the Capital Asset Pricing Model (CAPM):

Re = Rf + \beta (Rm - Rf)

Where:

* ( Rf ) = Risk-free rate (typically the yield on 10-year government bonds)
* ( \beta ) = Beta of the stock (measure of volatility relative to the market)
* ( Rm ) = Expected market return
* Rm - Rf = Market risk premium

**i. Risk-Free Rate (Rf)**

The risk-free rate represents the return on an investment with zero risk, typically associated with government bonds. It is the baseline rate of return expected by investors for taking no risk.

In the United States, the yield on 10-year U.S. Treasury bonds is commonly used as the risk-free rate. This information is available on the U.S. Department of the Treasury website.

**ii. Beta (B)**

Beta measures the volatility of a stock relative to the overall market. A beta of 1 indicates that the stock moves in line with the market. A beta greater than 1 indicates higher volatility (and potentially higher return), while a beta less than 1 indicates lower volatility.

It can be calculated by performing a regression analysis of the stock’s returns against the market returns over a specific period (here 200 market day window).

**Formula for Beta Calculation**:

β = Covariance (Stock Return, Market Return) / Variance (Market Return)

Where:

* **Covariance** measures how the stock’s returns move relative to the market’s returns.
* **Variance** measures the spread of the market returns.

**iii. Expected Market Return (Rm)**

The expected market return represents the average return expected from the market as a whole. It is based on historical returns and future expectations. Investment research reports and market analysis often provide estimates of expected market returns.

**iv. Market Risk Premium (Rm - Rf)**

The market risk premium is the additional return over the risk-free rate that investors require for taking on the higher risk of investing in the stock market. It reflects the difference between the expected market return and the risk-free rate.

**5. Cost of Debt (Rd)**

The cost of debt represents the effective rate a company pays on its borrowed funds. It is the return required by debt holders and is an essential component of the Weighted Average Cost of Capital (WACC). The cost of debt is typically lower than the cost of equity due to the lower risk associated with debt. It can be calculated as:

Rd = \frac{\text{Interest Expense}}{\text{Total Debt}}

**i. Interest Expense**

It is the total amount of interest the company pays on its debt over a specific period, typically a fiscal year. It represents the cost of servicing the company’s debt obligations. It is listed on the Income Statement of the company’s financial statements.

**ii. Total Debt**

Total debt includes all of a company's interest-bearing debt obligations, both short-term and long-term. It represents the total amount of borrowed funds that the company is required to repay.

Total Debt = Short Term Debt + Long Term Debt

**Short Term Debt:** Debt that is due within one year and can be obtained from the Balance Sheet of company’s financial statements. This includes Short-Term Loans (Loans that need to be repaid within a year), Commercial Paper (Short-term, unsecured promissory notes issued by the company) and Current Portion of Long-Term Debt (the portion of long-term debt that is due within the next year).

**Long Term Debt:** Debt that is due beyond one year and can be obtained from the Balance Sheet of company’s financial statements. This includes Bonds Payable (Long-term debt securities issued by the company to investors), Long-Term Loans (Loans with maturities greater than one year) and Debentures (Unsecured long-term debt instruments).

**6. Tax Rate**

The tax rate is the corporate tax rate that applies to a company's earnings. It reflects the proportion of income that a company must pay as taxes, and it is used to adjust the cost of debt for the tax-deductibility of interest payments.

Tax Rate = Income Tax Expense / Earnings Before Tax

**i. Income Tax Expense**

Income tax expense is the total amount of taxes a company is required to pay on its earnings for a specific period. It represents the cost of taxes on the company's profit. It can be found on the Income Statement of the company’s financial statements.

**ii. Earnings Before Tax**

Earnings Before Tax (EBT) is the company's income before any income tax expense is deducted. It is a measure of a company's profitability from its operations before accounting for taxes. It can be found on the Income Statement of the company’s financial statements.

**7. Weights of Equity and Debt**

The weights are based on the market value of equity and debt.

\frac{E}{V} = \frac{\text{Market Value of Equity}}{\text{Market Value of Equity} + \text{Market Value of Debt}}

\frac{D}{V} = \frac{\text{Market Value of Debt}}{\text{Market Value of Equity} + \text{Market Value of Debt}}

**V. Discounting Future Cash Flows**

**A. Purpose of Discounting**

The purpose of discounting future cash flows is to determine their present value. Because money today is worth more than the same amount in the future due to the time value of money, future cash flows must be discounted to reflect their value in today’s terms. This allows investors to assess the worth of future cash inflows and outflows from an investment.

**B. Applying the Discount Rate (WACC)**

In the DCF model, the Weighted Average Cost of Capital (WACC) is used as the discount rate. By applying WACC, we account for the opportunity cost of capital and the risk associated with the investment. The discount rate helps to adjust for the time value of money and ensure that the valuation reflects the expected return required by both equity and debt investors.

**C. Formula for Discounting Future Cash Flows**

The present value of each future free cash flow is calculated using the formula:

\text{PV} = \frac{\text{FCF}\_{\text{future}}}{(1 + \text{WACC})^n}

Where:

* ( \text{PV} ) = Present Value
* ( \text{FCF}\_{\text{future}} ) = Future Free Cash Flow
* ( \text{WACC} ) = Weighted Average Cost of Capital
* ( n ) = Number of years into the future

**VI. Estimating the Terminal Value**

**A. Definition of Terminal Value**

The terminal value (TV) represents the present value of a company’s future cash flows beyond the explicit forecast period. It accounts for the bulk of the total valuation in many DCF analyses, as it includes the value of cash flows generated indefinitely into the future. Estimating the terminal value is crucial for assessing the long-term sustainability and profitability of a business.

**B. Calculating Terminal Value**

Here, the Perpetuity Growth Model (Gordon Growth Model) is being used to calculate the Terminal Value. The perpetuity growth model assumes that free cash flows will continue to grow at a stable rate indefinitely. This method is appropriate for companies expected to have steady, perpetual growth.

\text{TV} = \frac{\text{FCF}\_{\text{final}} \times (1 + g)}{\text{WACC} - g}

Where:

* \text{FCF}\_{\text{final}} = Free cash flow in the final forecast year
* g = Perpetual growth rate
* \text{WACC} = Weighted Average Cost of Capital

**Perpetual Growth Rate:** The perpetual growth rate is the rate at which free cash flows are expected to grow indefinitely. This rate is generally assumed to be equal to or slightly above the long-term inflation rate or GDP growth rate.

**VII. Summing the Present Values**

**A. Overview**

The final step in the DCF valuation process is to sum the present value of the projected free cash flows and the discounted terminal value. This total represents the intrinsic value of the entire company. This step consolidates the estimated cash flows and terminal value into a single present value figure.

**B. Formula for Total Present Value**

The formula for the total present value is:

\text{Total PV} = \text{PV of Projected FCFs} + \text{PV}\_{\text{TV}}

Where:

* \text{PV of Projected FCFs} is the sum of the present values of the free cash flows projected over the explicit forecast period.
* \text{PV}\_{\text{TV}} is the present value of the terminal value

**C. Importance of Total Present Value**

The total present value provides a comprehensive measure of the company’s worth based on its expected future cash flows and the assumed growth rate beyond the forecast period. It is a crucial figure for investors and analysts to determine whether the current market price of the company reflects its intrinsic value.

**VIII. Determining the Intrinsic Value Per Share**

**A. Overview**

Once the total intrinsic value of the company is calculated, the next step is to determine the intrinsic value per share. This involves dividing the total intrinsic value by the number of outstanding shares. This per-share value helps investors compare the intrinsic value with the current market price per share to make informed investment decisions.

**B. Formula for Intrinsic Value Per Share**

The formula to calculate the intrinsic value per share is:

\text{Intrinsic Value Per Share} = \frac{\text{Total Intrinsic Value}}{\text{Number of Outstanding Shares}}

Where:

* \text{Total Intrinsic Value} is the adjusted total present value of the company.
* \text{Number of Outstanding Shares} is the total number of shares currently issued and held by shareholders.

**C. Importance of Intrinsic Value Per Share**

The intrinsic value per share provides a benchmark against which investors can compare the current market price of the stock. If the intrinsic value per share is higher than the market price, the stock may be undervalued, presenting a potential buying opportunity. Conversely, if the intrinsic value per share is lower than the market price, the stock may be overvalued.