

The Application of DCF in Company Valuation: Case of NVIDIA

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Abstract. Company valuation has always been a crucial theme in financial analysis and corporate management. It plays an important role in both corporate strategic adjustment and investment selection. NVIDIA is an American leading technology company dedicated to expanding into various areas including graphics processing units (GPUs), artificial intelligence (AI), autonomous vehicles, data centers, and other products. The stock of NVIDIA has been rising for several years and attract much attention from investors. Therefore, this paper combines DCF model with Fundamental analysis to value NVIDIA. Results of Fundamental Analysis shows that NVIDIA is in an accelerating technical environment. It has the product advantages in graphics processing units (GPUs) and artificial intelligence. From the results of DCF model, NVIDIA is outperforming as the current stock price far exceeds the estimated one, which shows that Nvidia's current share price is overvalued. Through case study, not only can it help the company position itself correctly, but also provide investors with a stock selection reference.

Keywords: Company Valuation, DCF Model, Fundamental Analysis, Stock Price Forecast, Performance Evaluation.

1. Introduction

In recent years, the wave of digital economy has swept the world. With the rapid development of artificial intelligence (AI), big data and accelerated computing power, the IT industry and technology companies has obtained huge growth opportunities and revenue potential. Both the government and enterprises attach greater importance to scientific and technological investment. Nvidia, as a leader in graphics processing units (GPUs) and generative AI, is generally believed by investors that it has a strong competitive advantage and is expected to continue to grow in the future, thus providing strong impetus for its share price to soar, once breaking through \$800. But most of the time, the share price does not truly reflect the fair value, so company valuation is necessary.

Company valuation is an important topic in corporate management. For company itself, it can serve as a basis for profitability assessment and strategy adjustment. For investors, they can analyze the stocks from company valuation so to create wealth maximization, thus choosing the right scrip for investment in deciding the true value or intrinsic value of a share [1].

Therefore, this paper takes NVIDIA as an example and mainly uses the DCF model for company valuation. Through the case study, it aims to allow people to correctly understand the true value behind the stock price and provide investors with a reference when choosing investment portfolios. At the same time, it can be used as a basis for enterprise market value management so to flexibly adjust strategies.

2. Literature review

Company valuation refers to the process of determining a company's true or potential value in the market. It can be divided into two levels: subjective and objective. The subjective value depends on the goals and desires of individuals, while the objective value is the value determined by the cost and benefits of the goods and services [2]. However, the valuation of companies is a serious challenge for financial analysts and appraisers all over the world, due to the fact that the value is intangible and difficult to quantify precisely [3].

Company valuation methodologies vary in complexity and applicability, the mainstream methods can include: relative value method, absolute valuation method and capitalize earnings approach, these

methods rely on principles of finance, including the time value of money and risk-return tradeoff. Among various valuation methods, the Discounted Cash Flow (DCF) method, along with the Capital Asset Pricing Model (CAPM), are probably the most extended and effective approach used in company valuation [4-6]. In addition, combined with other measurement methods, the DCF model has developed many new applications. For example, Karas Michal and Režňáková Mária adopt a hybrid modeling method to analyze the company's operating cash flow by using classification regression trees and logistic regression [7]. Fabio Buttignon address the valuation issue of distressed companies by constructing the Scenario Discounted Cash Flow (SDCF) model, which is designed to evaluate assets, debt and equity from current or potential new investors [8]. In addition, Kenth Skogsvik et al. examine the importance of bankruptcy risk in discounted cash flow equity valuation, specifically discussing two valuation models of the Dividend Discount Model (DDM) and Residual Income Valuation (RIV) models [9]. But the DCF method is prone to huge assumption deviations. Its main disadvantage is the extreme sensitivity of key variables such as weighted average cost of capital (WACC) and free cash flow (FCF) estimates, where even small modifications to the underlying assumptions of the analysis can significantly affect the valuation results [10].

However, it is still widely accepted that the DCF approach is an effective tool for analyzing the situation of an organization even in the most complicated circumstances. This paper adopts the DCF model and combines fundamental analysis methods to conduct a basic company valuation of NVIDIA. To a certain extent, it can enrich the application of DCF model in company valuation in reality, and give investors reasonable suggestions.

3. Method

3.1. Fundamental analysis

Fundamental analysis involves examining the impact of macroeconomic, technical and social factors on the company in order to have a basic understanding of the company and the industry it belongs to.

3.2. Discounted Cash Flow Valuation

3.2.1. Introduction to the absolute method of valuation

Discounted Cash Flow (DCF) is a method of pricing securities based on corporate free cash flow metrics and is an absolute valuation model. It is based on the company's historical and current fundamentals, expected future business conditions, and discounted future cash flow, profits, dividends and other indicators to obtain the company's current intrinsic value.

Here are some reasons for choosing DCF method:

(1) Robustness and objectivity: IT companies usually have high growth rates and profit potential, and their value often comes from cash flow, not just accounting profits. The core of DCF methodology is based on the valuation of cash flow by analyzing the company's financial data and making reasonable forecast assumptions, which can make the valuation results more objective and reliable.

(2) Long-term prospect: The IT industry involves rapid innovation and change, and usually requires significant capital investment, such as R&D and marketing. The DCF methodology takes into account the time value and return of capital investment, which is better able to cope with long-term outlook and uncertainty.

The two main approaches to the absolute valuation method are the Free Cash Flow to Firm (FCFF) and the Free Cash Flow to Equity (FCFE). This paper adopts the Free Cash Flow to Firm (FCFF) valuation method.

3.2.2. Calculation steps

Firstly, calculate the Free Cash Flow (FCF).

$$FCF = [EBIT \times (1 - \text{Tax Rate})] + \text{Depreciation} + \text{Amortization} - \text{Capital Expenditures} - \text{Change in Net Working Capital} \quad (1)$$

Next step is to estimate WACC for discounting.

$$WACC = \left(\frac{E}{V} \times R_e\right) + \left(\frac{D}{V} \times R_d \times (1 - T_c)\right) \quad (2)$$

Where $E = \text{Total Equity}$, $D = \text{Total Debt}$, $V = E + D$, $R_e = \text{Cost of equity}$, $R_d = \text{Cost of Debt}$, $T_c = \text{Tax Rate}$

Next, calculate the parameters needed for WACC. This paper uses the Capital Asset Pricing Model (CAPM) to determine the cost of equity capital.

Based on the CAPM, the cost of equity capital is calculated as:

$$R_e = R_f + \beta \times (R_m - R_f) \quad (3)$$

Where, $R_e = \text{Cost of equity}$, $R_f = \text{Risk Free Rate}$, $R_m = \text{Expected Market Return}$, $R_m - R_f = \text{Market risk premium}$ β is the market risk coefficient of a stock, which reflects the sensitivity of a company's return on equity to market returns?

The after-tax cost of debt is calculated as:

$$\text{After Tax Cost of Debt} = \frac{\text{Total Interest Cost Incurred} \times (1 - \text{Effective tax rate})}{\text{Total Debt}} \quad (4)$$

The debt-capital weight and equity-capital weight are calculated as:

$$\text{Debt weighting} = \frac{\text{Total debt}}{\text{Total Capital}} \quad (5)$$

$$\text{Equity weighting} = \frac{\text{Total Equity}}{\text{Total Capital}} \quad (6)$$

$$\text{Total Capital} = \text{Total Debt} + \text{Total Equity} \quad (7)$$

Next step is to calculate the firm value, it includes calculating the present value of cash flow, the present value of terminal value and perpetuity growth rate.

The present value of cash flows (PV of CF) is calculated as:

$$PV \text{ of CF} = FCF \times \text{Discount Factor} \quad (8)$$

Where, $\text{Discount Factor} = \frac{1}{(1+WACC)^n}$, $(n = 1, 2, \dots, 5)$.

Based on Gordon Growth Model, the growth rate is calculated as:

$$g = b \times ROE \quad (9)$$

Where $b = \text{retained earnings}$, $ROE = \text{return on equity}$.

The present value of terminal value is calculated as:

$$PV \text{ of Terminal Value} = \frac{FCFF_n \times (1 + g)}{WACC - g} \quad (10)$$

So, the firm value and net firm value are calculated as:

$$\text{Firm Value} = PV \text{ of CF} + PV \text{ of Terminal Value} \quad (11)$$

$$\text{Net Firm Value} = \text{Firm Value} + \text{Cash and Equivalents} - \text{Liabilities} \quad (12)$$

The last step is to calculate the per share price.

$$\text{Valuation per Share} = \text{Net Firm Value} / \text{Number} \quad (13)$$

3.3. Sensitivity analysis

Sensitivity analysis determines how different values of an independent variable affect a particular dependent variable under a given set of assumptions. Because the company's future development is

greatly uncertain, this paper adopts sensitivity analysis to measure how changes in growth rate and WACC will affect the company's value and share price. For a certain change step size, it needs to predict the changes in the firm value under different scenarios (generally economic depression, economic normality, and economic prosperity).

4. Results and discussion

4.1. Results of Fundamental Analysis

4.1.1. Macro analysis

Macro analysis involves two aspects: macroeconomic factors and technical factors.

Macroeconomic uncertainty. As inflation continues and interest rates rise further, the macroeconomic uncertainty puts great pressure on consumers and companies, resulting in weak long-term demand. Faced with the deepening macroeconomic uncertainty, major high-tech companies are diversifying risks by expanding their industrial chains and developing diversified businesses. NVIDIA has always been committed to technological innovation and has made major breakthroughs in the fields of graphics processors, artificial intelligence, and data centers. In recent years, NVIDIA has continuously launched new products, upgraded new technologies, and actively cooperated with partners to better adapt to changes in markets in different industries.

The booming development of U.S. digital economy. The MSCI Digital Economy Index aims to represent the performance of companies that are associated with the development of new products and services focused on the digital economy value chain. The data on Yahoo Finance shows that the index has been on an upward trend in the past 10 years, demonstrating that global investment in the digital economy has increased (figure 1). The digital economy is accompanied by the rapid development of accelerated computing and generative AI, which can use data to guide resources to functions, deeply integrate with various aspects of social economy, and empower the digital economy.

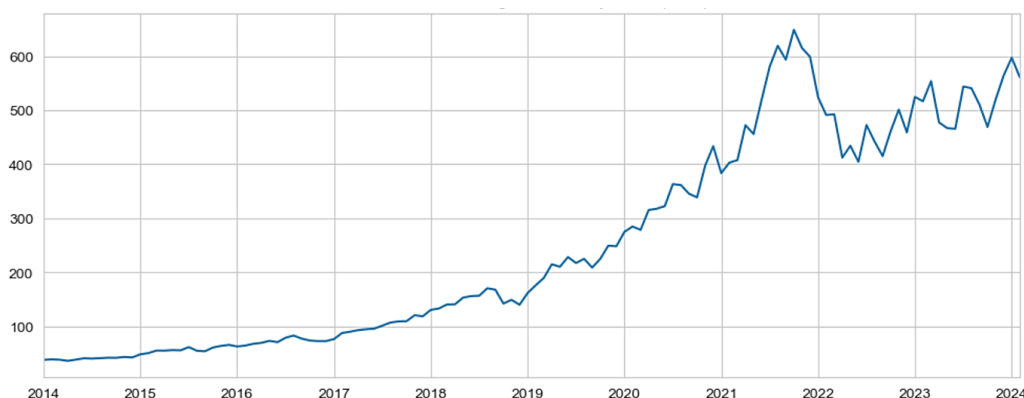


Figure 1. MSCI ACWI IMI Digital Economy Index (USD).

Analysis of technological factors. As ChatGPT arouses the world's attention, artificial intelligence develops rapidly. More and more companies and investors have been focusing on artificial intelligence technology. Besides AI, a large number of cutting-edge digital technologies, including Blockchain, Cloud, will be applied in business practices to promote new changes in human production methods and lifestyles.

In addition, while technological innovation, transformation and industrialization continue to accelerate, original innovation and quick re-innovation have become the core of technological competition in various regions, determining the international industrial division of labor and the global economic pattern.

4.1.2. Company analysis

NVIDIA is an American leading technology company dedicated to expanding into various areas including graphics processing units (GPUs), artificial intelligence (AI), autonomous vehicles, data

centers, and other products. At the center of the AI era, NVIDIA is recognized as a leader in industries mentioned above.

NVIDIA's main business can be divided into two parts: one is GPU, including the sale of GPUs for gaming and professional visualization; the other is Data Center, which mainly focuses on providing GPU-accelerated computing platforms for AI, high-performance computing (HPC), and data analytics applications.

Currently, NVIDIA's revenue exceeds US\$60.922 billion. Its revenues are primarily generated from advertising in the Compute & Networking, accounting for 77.81% of total revenues (table 1). Since 2023, revenue from Compute & Networking has grown rapidly, while revenue from Graphics has slowed down and demonstrated a slight downward trend.

Table 1. NVIDIA's Revenue Composition.

Segment	Currency: Billion in USD	Proportion
Compute & Networking	\$48.40	77.81%
Graphics	\$13.52	22.19%

NVIDIA has many product advantages in graphics processing units (GPUs) and artificial intelligence that make it one of the leaders in the field:

Graphics Power and High-Performance Computing. NVIDIA's professional-grade and consumer-grade graphics cards excel in graphics rendering, gaming, and design. Its GPU-accelerated computing solutions have been applied in scientific computing, medical image processing, weather forecasting and other fields and have achieved great success.

Artificial Intelligence Technology. In the field of artificial intelligence, NVIDIA develops deep learning and neural network accelerators such as Nvidia Tesla GPU and Nvidia AI Framework. These technologies provide powerful computing power and support for machine learning and deep learning applications.

4.1.3. Industry analysis

NVIDIA is involved in a wide range of industries. This paper selects the following fields for analysis:

Fundamental technology field. In the field of fundamental technology, technologies such as AI, blockchain, and cloud computing are inseparable from the strong support of Graphics Processing Unit (GPU). In this field, NVIDIA is undoubtedly the "top player" leading GPU computing, following which are AMD and Intel.

Omniverse, the computer graphics and simulation platform officially released by NVIDIA in 2019, integrates NVIDIA's technologies, algorithms, and standards in AI, HPC, and graphics over the past two decades, which can achieve real-time collaboration and accelerate design workflow, and is NVIDIA's technology platform base for creating a digital virtual space in the Metaverse.

Graphics processing and gaming field. In addition to NVIDIA, AMD (Advanced Micro Devices) is another leading graphics processor manufacturer. Its Radeon series graphics cards compete fiercely in high-performance gaming and graphics processing, forming a duopoly competition in the market with NVIDIA's GeForce series. In the game industry, game developers such as Electronic Arts (EA), Activision Blizzard, and Take-Two Interactive have developed and published many well-known game works and have an important impact on the development of the industry.

Artificial intelligence field. In the field of artificial intelligence, Google, Amazon, Microsoft and Meta, together with NVIDIA, constitute the core participants in the field of artificial intelligence in the United States, jointly promoting the development and application of artificial intelligence technology.

4.2. Results calculated by DCF model

This study adopts the Free Cash Flow to Firm (FCFF) valuation method to measure NVIDIA's firm value, the results are as follows:

Firstly, predict and calculate free cash flow for the next five years based on historical data. The specific calculation results are shown in table 2.

Table 2. The Calculation of FCF.

Summary Financials										
March YE (\$mm)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
EBIAT	3,403	5,691	11,35	7,340.	34,48	37,30	88,32	141,3	226,26	362,14
	.0	.0	1.0	0	0.0	2.6	6.8	69.3	5.1	3.1
+D&A	557.0	1,159	1,310	1,544.	1,508.	4,898.	7,840.	12,54	20,084.	32,145.
	.0	.0	.0	0	0	5	2	8.5	2	3
+ Maintenance capex	(489.0)	(1,128.0)	(976.0)	(1,833.0)	(1,069.0)	(4,563.3)	(7,303.7)	(11,689.8)	(18,709.9)	(29,945.6)
+ Change in working capital	(3,323.0)	(5,456.0)	(9,038.0)	(10,179.0)	(17,980.0)	(31,979.7)	(51,184.3)	(81,921.7)	(131,117.8)	(209,857.4)
+ Exceptional cash flows	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Other cash flows	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FCF	(966.0)	(2,052.0)	27.0	(6,216.0)	13,923.0	(4,139.0)	21,998.5	35,209.2	56,353.3	90,194.8

Next, estimate WACC for discounting. Based on the data available from Yahoo Finance, some parameters can be obtained directly: $R_f = 4.14\%$ $R_m - R_f = 4.72\%$ and $\beta = 1.725$. By calculation, $R_e = 12.28\%$ $R_d = 3.64\%$ $WACC = 12.24\%$

Next step is to measure the firm value by calculating the present value of cash flow, the present value of terminal value and perpetuity growth rate. The specific calculations are shown in table 3.

Table 3. The Calculation of Present Value.

Net Present Value based on Perpetuity Growth Method		
	Value Based on 12.24% WACC & 4.0% TRG	Amount (\$m)
Present Value of Cashflows		0
PV of Terminal Value		639072
Implied Firm NPV		763889
Net debt & adjustments		(3776)
Implied equity value		760113
Implied share price (\$c)		305
% premium to current		-65%

4.3. Results of Sensitivity analysis

Through further sensitivity analysis, this study selected 0.2% as the change step size of growth rate and WACC, and calculated NVIDIA's firm value and share price under different growth rate and WACC. The results show that the share price range of NVIDIA is \$298 to \$412, with a value pivot at \$305. The specific calculations are shown in table 4.

Table 4. Sensitivity Analysis.

Sensitizing firm value (\$m) and implied offer price to WACC and TGR						
		Perpetuity Growth Rate (%)				
		0.00%	0.20%	0.40%	0.60%	0.80%
WACC (%)	11.8%	564416 / 225c	664263 / 413c	815314 / 325c	1070539 / 428c	1594420 / 638c
	12.0%	552387 / 220c	647921 / 410c	791222 / 316c	1030057 / 412c	1507728 / 603c
	12.2%	540771 / 215c	632241 / 407c	763889 / 305c	992221 / 396c	1429340 / 572c
	12.4%	529548 / 211c	617186 / 404c	746556 / 298c	956782 / 382c	1358123 / 543c
	12.6%	518699 / 206c	602719 / 402c	725818 / 290c	923522 / 369c	1293142 / 517c

From the table, it can be found that for a given WACC, a slight change in the growth rate can bring about a drastic change in the company's value and share price. However, for a given growth rate, the increase or decrease in WACC has a small impact on the firm value and share price. Therefore, in this sensitivity analysis, the firm value and share price are more sensitive to changes in growth rate.

4.4. Performance Evaluation

Through comparison, it can be intuitively found that the current share price (\$859.64) is much higher than the predicted value of the DCF model (\$304.78). Judging from the overall market sentiment, it may be that the market is over optimistic about NVIDIA's business prospects, technological innovation or other factors, along with investors have higher expectations for its future profitability and long-term growth potential, causing share prices to deviate from fundamental valuations. In this case, the company's performance is considered good.

High share prices also mean high risks, explicit and potential risk factors cannot be neglected. For example, intensified market competition, technological innovations, supply chain issues and macroeconomics could have significant impact on the company's performance. Therefore, investors cannot only make decisions based on the results of the DCF model, but also need to comprehensively consider various factors to make decisions.

4.5. Further discussion: Disadvantages of the DCF model

When applying the DCF absolute valuation method, its shortcomings should be noted:

(1) Difficulty in forecasting

The DCF method relies on predicted future cash flow forecasts, but for long-term projects, especially when faced with a macroeconomic environment with many uncertainties, accurate cash flow forecasts will become very difficult and may deviate from actual economic conditions.

(2) Ignoring non-cash factors

The DCF methodology focuses primarily on cash flow and ignores the impact of other factors on investment decisions, such as a company's brand value, industry trends, and the competence of the management team, which may lead to an overall lack of evaluation power.

(3) Impractical theoretical assumptions

The DCF model uses an estimated discount rate to discount future cash flows to obtain the present value. But discount rates are often based on assumptions and estimates, which can produce different results with different assumptions. In addition, it is difficult to obtain a definite long-term growth rate by relying solely on idealized models.

5. Conclusion

In conclusion, this paper adopts Discounted Cash Flow method to predict NVIDIA's financials in the next five years, and calculates free cash flow, finally obtaining NVIDIA's enterprise value and share price. Because there is great uncertainty in the future, this study calculates the enterprise value and share price under different WACC and growth rates. The sensitivity analysis obtains a share price range of \$298 to \$412 for NVIDIA, with a value pivot at \$305. By comparison, the current share price is significantly higher than the predicted one. It can be concluded that the company is currently performing well and has strong growth momentum.

There are several implications in this paper. For NVIDIA, due to its leading technical advantages, as well as the surge in global demand for accelerated computing and generative AI in recent years, the public has overly optimistic expectations for NVIDIA's future growth and profit potential, which has led to the current surge in share prices. At the center of the AI era, If NVIDIA can continue to technological innovating and maintain its growth momentum, even if it faces the high risk, it will still be able to exceed expectations time and time again, and become a real growth stock. For investors, they need to weigh the difference between the DCF model's predictions and fair value. By taking into

account the company's fundamentals, industry prospects, risk factors, investors must be more cautious and avoid blindly chasing the rise.

However, due to the difficulty in predicting future development, and the lack of consideration for market competition, technological innovation and other factors, the DCF calculation in this paper has some limitations. In the future study, it is valuable to improve the model to get a more robust conclusion.

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