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Equity Research – Nvidia:
Technology Giant Put Through the Financial Lens

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Abstract

This individual report analyzes how NVIDIA has performed in the past few years, addressing questions such as liquidity, capital structure, returns and key drivers, following its recent enormous boost in stock price.

Furthermore, the company's future is evaluated and predicted, considering a Discounted Cash Flow analysis, through Weighted Average Cost of Capital.

To conclude, a final recommendation for investors is given, considering all analyzed data.

Keywords

NVIDIA, Artificial Intelligence, Equity Research, Semiconductors

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This report is part of the “Equity Research - Nvidia: Technology Giant Disrupts the Market” report (annexed), developed by Ana Filipa Vieira and António Calabote and should be read as an integral part of it.

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Introduction

The present Equity Research aims to value NVIDIA, amid its meteoric rise in stock price, and attempt at understanding the reasons behind it, if it is sustainable, that is, how long can such an increase last.

The firm has been performing rather well in the past few years, despite not minimizing risk in its activity and its increase of stress in liquidity. Moreover, in the aftermath of one of the most volatile events in recent history, NVIDIA has succeeded and is thriving in potential to invest.

The first section of this joint report contains the company description, its history, how it is divided in segments, what products it creates, how equity is structured, and its business model along with any associated risks. Moreover, this first part of the joint report also entails the macroeconomic context that surrounds the company and how consumer shifts are affecting it.

Finally, in the second portion of the joint document, covered in this individual report, there is the reformulation of NVIDIA's financial statements, how it manages inflows and outflows of cash, how liquid it is and how it distributes financing between equity and debt. Furthermore, the items that mainly drive sales and costs, as well as invested capital, are addressed, the kind of return the company offers to its investors, and how it is expected to grow in the future. To that purpose, a Discounted Cash Flow analysis was performed, using Weighted Average Cost of Capital as the discount rate.

To conclude, a final recommendation for investors is given, taking into account all aspects of this examination.

Market Overview and Main Drivers

Initially, how NVIDIA has conducted its inflows and outflows across the years, as to ensure a liquid situation in more dire times, will be addressed in this section. Consequently, the distribution between equity and debt has been within the firm (capital structure) and how the most relevant drivers in both sales and costs have impacted the ratio in the past few accounting periods are going to be considered. Furthermore, the relevance of the company's invested capital, stemming from already existent to invested capital related to new opportunities, as well as the return originating from it and from equity itself will be discussed. Moreover, how sales are expected to grow in the future and how value is perceived to be created will be approached¹.

The following figures have also been computed for AMD² and Intel³, two of NVIDIA's biggest competitors, to perform a comparative analysis.

Cash Flow Management

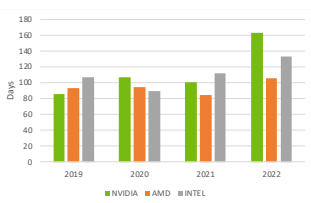
First, an indirect analysis was performed, by combining multiple captions from the firm's financial statements into a few ratios that aid in explaining what the company's cash flow management has been in the last years. Even though there are some limitations to ratio analysis, it still provides a fair diagnosis of the company's financial performance.

The number of days, on average, that inventories remain in the firm before being sold (Average Holding Period) were studied (Figure 1). During the analysed period (2019 to 2022) this figure has doubled, having gone from 86 days to 162. Looking at their competitors, namely AMD and Intel, they have both increased (from 93 to 106 and from 107 to 133, respectively), but not with the significance registered in NVIDIA's case, thus meaning that the stress on the company's liquidity might be higher, that is, the probability of needing and resorting to external financing is higher, increasing financing costs as well.

Furthermore, the number of days, on average, that it has been taking the company to gather sales from clients (Average Collection Period) has been computed (Figure 2). NVIDIA has observed a reduction of this ratio, although not being a substantial one (from 55 to 52 over the analysed timeframe, recording a high in 2021 with 63 days, in average). Compared with its competition, NVIDIA's reduction is less significant: AMD reduced from 101 to 64 (NVIDIA still has a smaller ratio, despite AMD's considerable decrease) and Intel from 39 to 24 (best overall ratio). Having registered this decrease, this ratio describes a better scenario than the first one did.

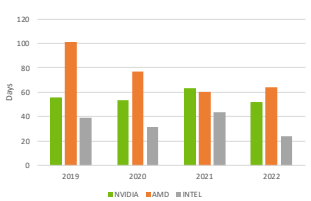
Additionally, a third calculation was addressed: Average Payable Period, that is, on average, the number of days that it has been taking the firm to reimburse its suppliers (Figure 3). NVIDIA has decreased this figure from 60 to 37 over the analysed period, whereas AMD decreased from 93 to 70 and Intel, on the other hand, has observed an increase from 51 to 97. For

Figure 1: NVIDIA and Peers' Average Holding Period



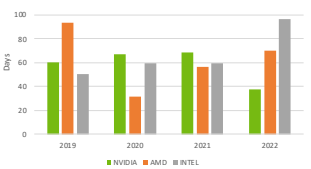
Source: Authors' Calculations

Figure 2: NVIDIA and Peers' Average Collection Period



Source: Authors' Calculations

Figure 3: NVIDIA and Peers' Average Payable Period



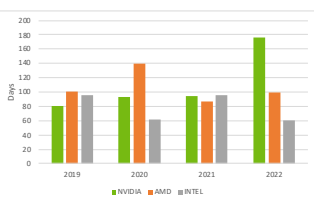
Source: Authors' Calculations

¹ Information collected from the 2021, 2022 and 2023 "NVIDIA Corporation Annual Review" Reports (2022 refers to the fiscal year ending in January 2023; the same logic applies in the remaining years).

² Information collected from AMD's 2021, 2022 and 2023 Form 10-K.

³ Information collected from Intel's 2021, 2022 and 2023 Form 10-K.

Figure 4: NVIDIA and Peers' Cash Conversion Cycle



Source: Authors' Calculations

NVIDIA, this when Average Payable Period is lower, stress on liquidity is higher.

To sum up, Cash Conversion Cycle was quantified from the three previous ratios (Figure 4). Cash Conversion Cycle refers to the number of days that, on average, has been taking the company to carry out its normal trade cycle. NVIDIA has observed an increase from 81 days to 176 in this ratio. Given that it should be as low as attainable, this does not portraint a particularly good sign for the firm in what concerns its activity, as risk is not minimized, and liquidity (see ahead) is resorting to external means and thus increasing debt.

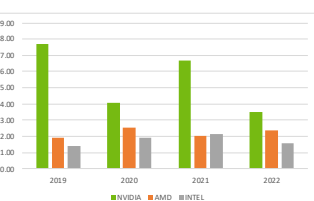
Whereas AMD's Cash Conversion Cycle has remained unaltered during this timeframe, the same cannot be said for Intel, since it has decreased from 95 to 61, describing a better overall trajectory than NVIDIA.

Liquidity

Following what was done regarding Cash Flow Management, an analysis through select ratios was carried out in order to verify NVIDIA's ability to comply with its short-term liabilities, considering the company's current activity scope.

Firstly, the Current Ratio was computed, establishing the firm's ability to cover its short-term liabilities using all of its short-term assets (Figure 5). So, NVIDIA's current assets proportion in terms of current liabilities has decreased substantially, going from 7.67 in 2019 to 3.52 in 2022. AMD and Intel's Current Ratios are considerably smaller than that of NVIDIA's (both never surpass 3 during the aforementioned period for analysis). However, both have increased: AMD's from 1.95 to 2.36 and Intel's from 1.40 to 1.57 (both with some intermittence). NVIDIA's value always is above 1. Therefore, the firm has financial short-term equilibrium, at least. When analysing these years, it could be seen that cash and cash equivalents decreased, thus affecting negatively current assets. On the other hand, for instance, Property and Equipment (Net) described an increase, so perhaps there was a strategic shift to allocate a part of Cash and Cash Equivalents to these non-current assets, thus decreasing the proportion of current assets relative to current liabilities.

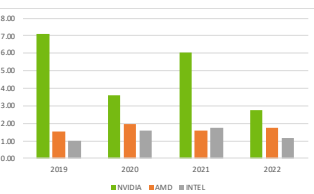
Figure 5: NVIDIA and Peers' Current Ratio



Source: Authors' Calculations

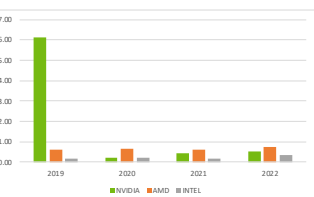
Afterwards, the company's ability to cover its short-term obligations with current assets was addressed, assuming that inventories are unsellable in the short run: Quick Ratio (Figure 6). Concerning this figure, the trend from Current Ratio continued, with NVIDIA's values having decreased (from 7.13 to 2.73), whereas AMD's (from 1.53 to 1.77) and Intel's (from 1.01 to 1.16) increased. Given all the values above, at least, NVIDIA has met the minimum financial short run equilibrium criterium.

Figure 6: NVIDIA and Peers' Quick Ratio



Source: Authors' Calculations

Figure 7: NVIDIA and Peers' Cash Ratio

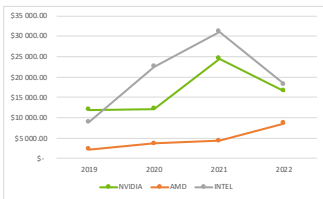


Source: Authors' Calculations

Additionally, the Cash Ratio was computed, that is, the company's capacity to cover its short-term liabilities using only cash and cash equivalents at its disposal (Figure 7). NVIDIA's value has decreased greatly over the observed timeframe, going from 6.11 to 0.52, a particularly low number. Considering its competitors, this figure has increased in both cases. However, the values are low as well (AMD's Cash Ratio increased from 0.62 to 0.76 and Intel's also from 0.19 to 0.35). Regarding NVIDIA, this decrease might be related to a worsening of its liquidity position, taking into account that the first two ratios also decreased, which means that NVIDIA is probably more subject to its capacity to realize current assets in the short run in order to cover

its short-term liabilities (higher risk). These liquidity ratios have an ambiguous analysis. Whereas they should be as high as possible, firms also should not have too much money on demand if it is not being used.

Figure 8: NVIDIA and Peers' Net Working Capital

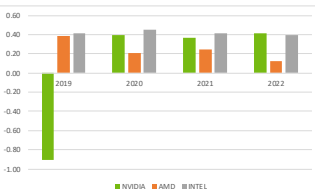


Source: Authors' Calculations

Moreover, a fourth figure was calculated: Net Working Capital, which consists of the difference between current assets and current liabilities and represents the quantity of money that the firm requires to function properly and conduct its daily business (Figure 8). NVIDIA's Net Working Capital, with some instability in the middle of this timeframe, has increased between 2019 and 2022. Following the same pattern, AMD and Intel also saw their Net Working Capital increase over the mentioned period. It has already been seen that NVIDIA's stress on liquidity had grown during the activity ratio analysis, beyond the ideal point, which is now verified by its higher Net Working Capital, since it increasingly needs more liquidity, that is, higher current assets when compared to its current liabilities, to run its daily operations.

Capital Structure

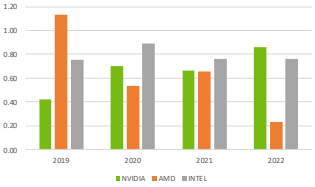
Figure 9: NVIDIA and Peers' Gearing Ratio



Source: Authors' Calculations

To commence the third ratio analysis of this Equity Research, the Gearing Ratio was studied, which is a measure for Capital Structure (Figure 9). The Gearing Ratio analyses the proportion of Net Debt to Invested Capital, which is the sum of Net Debt and Equity. In NVIDIA's case, the value has increased over the years, which means that the percentage of Net Debt has grown in terms of Invested Capital. The same has not occurred with its competitors since AMD and Intel saw their Stockholders' Equity increase in the same timeframe, for instance.

Figure 10: NVIDIA and Peers' Debt-to-Equity Ratio

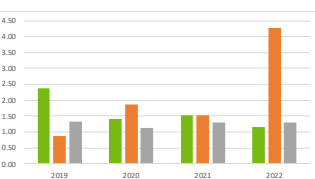


Source: Authors' Calculations

In a similar sense, the Debt-to-Equity ratio was computed, which, as the name states, evaluates the percentage of Debt in terms of Equity (Figure 10). The trend observed in Net Working Capital continued in Debt-to-Equity, with NVIDIA having increased, and AMD decreased. The one outlier is Intel, which remained the same, with some fluctuation in between. Nevertheless, it is noteworthy that all three companies reached the end of 2022 with a Debt-to-Equity ratio inferior to 1, which means that Equity is higher than Net Debt in all instances (not the case in 2019, when AMD had a value of 1.13).

Given that these two ratios have grown over the years for NVIDIA, it means that it is more likely that the company will not be able to meet payment obligations in the near future, as Debt's portion in terms of Equity has risen, so the amount that has to be paid back enlarges proportionally. On the other hand, this shift in capital structure (increase from 0.42 to 0.86 in the Debt-to-Equity ratio) may indicate that the firm uses more debt to increase its savings in taxes (tax shield), which can indeed be seen in NVIDIA's Consolidated Statement of Income, with Interest Expense having increased (in absolute terms) between 2019 and 2022, from 52M\$ to 262 M\$. One explanation can be the physical nature of NVIDIA's assets that may contribute to the obtainment of debt at less expensive terms.

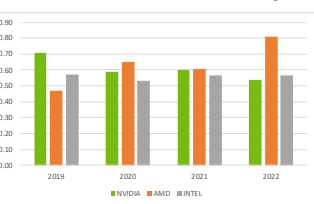
Figure 11: NVIDIA and Peers' Solvency Ratio



Source: Authors' Calculations

Furthermore, another figure was addressed: the Solvency Ratio, which measures the proportion of the Equity value in terms of Liabilities (Figure 11). This enables an overview of the company's capacity to cover its liabilities with the capital that was invested in it or that it created. NVIDIA's figure has reduced to a little less than half during this period (from 2.39 in 2019 to 1.16 in 2022). Simultaneously, AMD grew to almost five times the initial value (from 0.88 to 4.27 in the mentioned timeframe) and Intel has observed its Solvency Ratio marginally decrease in the

Figure 12: NVIDIA and Peers' Financial Autonomy



Source: Authors' Calculations

observed timeframe (from 1.32 to 1.31).

Moreover, a fourth ratio was computed: the Financial Autonomy Ratio, which assesses the firm's freedom from its creditors (Figure 12). NVIDIA's values decreased from 0.70 in 2019 to 0.54 in 2022, whereas AMD's increased, and Intel's remained unaltered (from 0.47 to 0.81 and remained at 0.57 in the observed period, respectively). Thus, NVIDIA's independence has decreased since its assets have lower coverage from its equity.

Reformulation of Financial Statements and Assumptions

In order to begin NVIDIA's valuation, a reorganization of its financial statements was performed, namely its Consolidated Statements of Income and Consolidated Balance Sheets. Both these documents were divided into three segments: Core Operations, Non-Core Operations, and Financial Items.

Considering the firm's Reformulated Consolidated Statements of Income, Core Operations entail captions directly linked with its day-to-day operations, such as Revenue, Cost of Revenue, Research and Development Costs, Sales, General and Administrative Expenses, and Acquisition Termination Cost, as well as Statutory Taxes and Taxes Adjustments. Regarding Non-Core Operations, items that are not believed to be absolutely linked to daily business were included. Finally, a caption that contributes to the company's means of financing in the "Financial" section of the Reformulated Consolidated Statements of Income was set aside, with Interest Expense, for instance.

On the other hand, now looking into NVIDIA's Reformulated Consolidated Balance Sheets, Core Operations encompass items like Operating Cash, Accounts Receivable, Inventories, Prepaid Expenses and Other Current Assets, Property and Equipment, Operating Lease Assets, Goodwill (once it is linked to the company's core value), Intangible Assets, Other Assets, Accounts Payable, Accrued and Other Current Liabilities, Short-Term Debt, and Long-Term Operating Lease Liabilities.

Additionally, "Operating Cash" is one remarkable caption. It is not mentioned in NVIDIA's original financial statements. It is a self-computed caption in this reorganization that derives from the initial caption "Cash and Cash Equivalents", due to the unnecessary amount present in the original item, as only a part of it (part linked with liquidity) should be associated with Core Operations. To that purpose, a rule establishing that Operating Cash should be 5 percent ⁴ of the amount of Revenues was designed, with the rest being reallocated into the caption "Excess Cash". Moreover, Non-Core Operations are composed of captions that are auxiliary to the ones addressed above, such as Excess Cash, Marketable Securities, and Deferred Income Tax Assets. To conclude, the Financial part of the Reformulated Consolidated Statements included Long-Term Debt, as a means of financing the company.

Sales' and Costs' Value Drivers

In order to address Sales' and Costs' Value Drivers a line item analysis was performed, which

⁴ Source: Morgan Stanley's Counterpoint Global, October 2022.

enables an overview of the forces behind the increase or decrease of each caption over time. In both cases revenues were considered the main driver for these items. Being that stated, sales and costs were divided, as well as their driver's influence on them, according to NVIDIA's designated operational segments: Compute & Networking, Graphics, and All Other. It is noteworthy that the "All Other" segment is only relevant in costs because there is not any mention of it along the sales process.

Figure 13: Evolution of Sales' Value Drivers in NVIDIA

NVIDIA: EVOLUTION OF SALES' VALUE DRIVERS				
	2020	2021	2022	CAGR
Compute & Networking	108.63%	61.47%	36.41%	66.25%
Graphics	28.73%	61.36%	-24.97%	15.94%

Source: Authors' Calculations

In Sales' Value Drivers (Figure 13), the "Compute & Networking" segment has gained particular importance over the years, having grown from 30.03% of Total Revenues in 2019 to 55.86% in 2022. Contrarily, the "Graphics" segment has had the opposite trajectory: its proportion in terms of Total Revenue has decreased from 69.97% to 44.14% during the mentioned timespan. Due to these evolutions, "Compute & Networking" segment was considered the main driver for Sales and was largely taken into account in the following revenue projections.

Figure 14: Evolution of Costs' Value Drivers in NVIDIA

NVIDIA: EVOLUTION OF COSTS' VALUE DRIVERS				
	2020	2021	2022	CAGR
Compute & Networking	69.82%	50.20%	54.85%	58.07%
Graphics	19.44%	41.25%	-0.30%	18.93%
All Other	124.23%	16.02%	77.47%	66.51%

Source: Authors' Calculations

Costs' Value Drivers (Figure 14) have described a similar trend over the years, with the "Compute & Networking" segment having increased in terms of Total Revenues (growth from 23.15% in 2019 to 37.02% in 2022) and the "Graphics" segment going in the opposite direction (decrease from 40.04% to 27.26% over the studied period). Moreover, the "All Other" operational segment percentage in terms of Total Revenue has increased from 10.73% to 20.06% in these years.

Additionally, it is important to state that all these segments, be it in sales or costs, have increased in absolute terms across the aforementioned timeframe, with particular highlight for the "Compute & Networking" segment, which had Compound Annual Growth Rates of 66.25% in Sales and 58.07% in Costs.

Invested Capital Value Drivers

As in the case of Sales' and Costs' Value Drivers, a line item analysis for Invested Capital Value Drivers was performed. In most instances revenues were the driver, such as: Operating Cash, Accounts Receivable, Inventories, Prepaid Expenses and Other Current Assets, Operating Lease Assets, and Other Assets, in Core Operations, as well as Marketable Securities, in Non-Core Operations. Furthermore, in Core Operations, "Inventories" were identified as the driver for "Property and Equipment", as an increase of the former is most likely linked to an increase of the latter in a company of this nature. Finally, through the firm's financial statements, it became clear that Research and Development is highly linked with both Intangible Assets and Deferred Income Tax Assets, so it was considered as the main driver in the two cases.

Subsequently, it is of particular interest that the caption with the highest Compound Annual Growth Rate in Core Operations is "Intangible Assets" (224.61%), thus reinforcing the company's innovative position in the market.

NVIDIA's "Graphics" segment is responsible for gaming and PC GPUs (GeForce), GPUs for enterprise graphics (Quadro/NVIDIA RTX), gaming streaming platform (GeForce NOW), among others. Even though this is thought as a promising segment for the firm, the "Compute & Networking" segment is considered a far more interesting business portion for NVIDIA's future, given that it comprises Data Center platforms for Artificial Intelligence, autonomous driving

solutions, robotics platforms, etc, which are all very fast-growing markets with enormous exploration potential, and comprise the firm's most valuable assets. To this purpose, it is considered that NVIDIA is likely to continue its path of acquisitions, such as Mellanox (in 2020), which belongs currently to the latter segment, so to speed up NVIDIA's growth compared to its peers.

ROE and ROIC

Return on Equity (ROE) is a measure of how shareholders are duly compensated for each unit of investment taken within the company. NVIDIA's Return on Equity has increased from 38.03% in 2020 to 59.76% in 2021. However, a much higher decrease followed, with the value going down to 17.85% in 2022. Given that Return on Equity should be as high as attainable (when ROIC is its main driver), this could be a better indicator. When Return on Equity is high, firms have more direct access to raising capital (easier to meet obligations than companies that distribute lower returns to their stockholders, and therefore are more trustworthy in terms of payback), which can help in case liquidity struggle arises. Nevertheless, its peers have also observed a decrease of their Return on Equity, and NVIDIA was only behind AMD in this indicator by a few percentage points in 2022 (AMD's was 17.37%).

Furthermore, despite the increase in the Debt-to-Equity ratio, it can be seen that the main driver in the evolution of Return on Equity described in the studied period was the similar evolution in Return on Invested Capital (ROIC). As in Return on Equity, Return on Invested Capital was computed with a "lag" assumption, given that it is not expected an immediate yield from investments (assumption of a 1 year lag). Return on Invested Capital has increased from 31.67% in 2020 to 43.35% in 2021 but has taken a higher decrease afterwards to 12.10% in 2022, following the pattern described initially. The biggest difference to pinpoint here is that in 2022 NVIDIA sat substantially closer to the bottom in the competition panorama in Return on Invested Capital (Intel, which is the firm with the worse ratio of the three, has a ratio of 8.17%, and AMD a ratio of 20.63%, the best out of the three), whereas in Return on Equity NVIDIA is quite close to the top.

It should be noted as a kind remark that Return on Equity and Return on Invested Capital might be subject to differences, depending on the accounting reporting nature of each enterprise, that is, for example, firms growing through acquisitions are allowed to remeasure the assets and liabilities of their target companies (in addition to eventually recording Goodwill) and to capitalize specific costs, whereas others that primarily choose internal growth and development (organic evolution) typically have a "less inflated" Consolidated Balance Sheet.

Value Creation Analysis and Growth Rate of Sales

To evaluate how NVIDIA indeed creates value, the evolution of Return on New Invested Capital (RONIC) was studied. Overall, NVIDIA's Return on New Invested Capital worsened over the considered timespan. Comparatively, AMD's also described a negative trajectory, but the difference was even bigger in percentage points. On the other hand, Intel registered a significant improvement over the analysed timeframe. It is noteworthy that Core Value Creation is distinctly the most significant driver of Value Creation within NVIDIA.

Moreover, two ratios that address the ends of Net Income were computed: Payout Rate and Investment Rate, which sum to 100%, as either Net Income is distributed as dividends to shareholders (Payout Rate) or retained by the firm to drive new investment opportunities (Investment Rate).

Over this period, NVIDIA's Investment Rate reached levels above 85% in almost every instance, which indicates that the firm prefers to reinvest its earnings in interesting business ventures rather than pay shareholders out immediately, which indicates that the shareholders themselves recognize better value in exploring said opportunities through NVIDIA than to gather their fair share of earnings at that point in time.

Furthermore, the growth of sales per operating segment was derived. Across the mentioned timespan, the "Compute & Networking" segment's sales increase in a sustained fashion, even though this growth rate has been slowing down. On the other hand, the "Graphics" segment's sales increase from 2019 to 2020 and grow even more in the following fiscal year, but then decreases considerably from 2021 to 2022, thus revealing that the former is the most accurate and reliable sales driver in what concerns NVIDIA's operational business segments.

Valuation

After reviewing and reformulating the company's financial statements, studying how cash flow is managed, how liquid the firm has been and how capital has been structured in the past few years, what captions indeed drive sales, costs and invested capital and finally the return the firm has been able to achieve in terms of equity and invested capital to create value through new investments (RONIC) and grow sales, NVIDIA's valuation was performed, which will be addressed henceforth, culminating in a final recommendation concerning what position to take regarding said firm's equity. Therefore, in this section core revenues forecast up until 2032 are computed (the end of the previsions, excluding terminal value) and also core costs to derive what core invested capital will be like over the next decade.

Moreover, the cost of capital was computed, which includes mainly capital structure, cost of debt and cost of equity assumptions in order to obtain a realistic and confident figure for the Discounted Cash Flow model, which will be the primary method for this assessment. Afterwards, core value, equity value and terminal value are derived from the previous assumptions and computations and long-term drivers of value are evaluated as to gather a conclusion for the Discounted Cash Flow analysis.

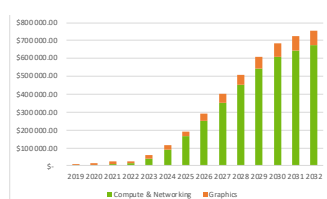
Thereafter, NVIDIA stock's recent past is described to get a fair value basis for comparison, upon which a sensitivity analysis is developed to assess any prospective future outcomes to ultimately support the final advice.

Core Revenues Forecast

Forecasting core revenues is one of the main steps in properly evaluating a company, especially one like NVIDIA. Core revenues hold a very strong importance in the midst of a valuation due to the impact they also impart on various other captions from the financial statements, given that, as it was seen previously, core revenues are the driver for many items in

both Consolidated Statements of Income and Consolidated Balance Sheets, and captions were forecasted according to the portion in terms of their respective drivers.

Figure 15: Forecast for NVIDIA's Core Revenues



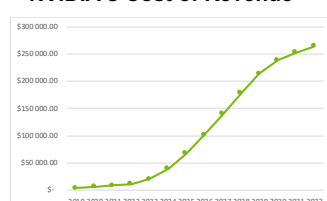
Source: Authors' Calculations

NVIDIA registered enormous core revenues growth (Figure 15) between 2019 and 2020, and 2020 and 2021 (52.73% and 61.40%, respectively). Afterwards, it continued to grow, but with a deceleration between 2021 and 2022, having just grown 0.22%. Therefore, very good perspectives of growth were considered for the company. So, an expansive position was taken. Core Revenues forecast was performed by segments, as it was assumed that both segments would grow at different rates. As stated previously, the main driver for Core Revenues is the "Compute & Networking" segment. So, a 180% "Compute & Networking" growth rate was assumed for 2023 (analysts' predictions are between 180% and 200%⁵). Afterwards, the growth rate was slowly decreased: 115% for 2024, 80% for 2025, 55% for 2026, and 40% for 2027. Then, the forecasted rise in Core Revenues for the segment slows down even further to 28% in the following year (2028), after which the expansion reduces to a 20% yearly rate in 2029, 12% 2030, and 6% in 2031. Afterwards, the forecasted rate was of 3.5% for 2032 (steady state). Moving on to the "Graphics" segment, a more conservative approach was taken. Starting with a 40% growth rate for the segment in 2023 (given past values of growth within the segment), 2024 registered 35%, and 2025 30%. Then, 2026 and 2027 had a growth rate of 25%, and 2028 and 2029 one of 20%. Finally, 2030 registered a growth rate for the segment of 10%, and 2031 one of 5%, up until 2032, when it is projected to be 3%. These values will yield an overall growth rate for Core Revenues in 2032 of 3.45%.

Moreover, it is worthy of mention that this steady state growth rate was kept at around 3% to be between the historical values for the inflation rate (2-3%) and the historical GDP Growth Rate (4-5%), also to be in accordance with reviewed literature⁶.

Core Costs Forecast

Figure 16: Forecast for NVIDIA's Cost of Revenue



Source: Authors' Calculations

Moving on from core revenues, focus went to how Core Costs were to evolve over the advanced timeframe.

NVIDIA's Cost of Revenue values (Figure 16) were always somewhere between 35% and 45% from 2019 to 2022, so it was considered fitting to select 35% as the Cost of Revenue portion of revenue from 2023 to 2032.

Furthermore, Sales, General and Administrative Costs were forecasted through the simple average of the figures in terms of their driver (Revenue) between 2019 and 2022, thus remaining unaltered through the projected period, being 9.68%, proportionally. Research and Development was put constantly at 20%, so to be a value belonging to the interval of past rates (closer to the lower bound). The "Acquisition Termination Cost" line item, as the name states, is not worth forecasting since it is a 2023 terminal figure with no future representation nor validity projection-wise.

⁵ Source: Retrieved on 18th December 2023, from: <https://www.bloomberg.com/quote/NVD:GR?leadSource=uverify+wall>

⁶ Source: Goedhart, M., Koller, T., Wessels, D., "Valuation: Measuring and Managing the Value of Companies", McKinsey & Company, p. 92.

Core Invested Capital

Having already addressed the main components in the forecasting process of the Consolidated Statements of Income, through the Core Result (Core Revenue minus Core Costs) projection, the Consolidated Balance Sheets were predicted, through the estimate of Core Invested Capital for the period comprised between 2023 and 2032. To that purpose, a 5% proportion in terms of Revenue for Operating Cash was kept. So, it increases at the exact same rate as Revenue throughout this timeframe.

Predictions of Accounts Receivable, Net, and Inventories were based on the simple means of Average Collection Period (52) and Average Holding Period (162) between 2019 and 2022, respectively. Moreover, Prepaid Expenses and Other Current Assets, Operating Lease Assets, and Other Assets were derived from the simple averages of these items' proportion in terms of their respective drivers in the years that have already transpired, remaining steady throughout the course of this projection. "Property and Equipment" has mainly been driven by "Inventories", so the proportion in terms of the driver decreased to 70% in 2023, remained at that level until 2026 when it became 65%, keeping at that level until 2029, when it turned to 60% (steady state). Goodwill was kept constant throughout the forecasted period. On the other hand, the future values of the caption "Intangible Assets, Net" were computed from the last available percentage regarding its driver (from 2022), which is Research and Development. So, this percentage remains unaltered throughout the forecasted period. Moreover, now addressing liability items, Accounts Payable was calculated according to the simple mean of its percentage in terms of Cost of Revenue, its driver. Additionally, Accrued and Other Current Liabilities, Short-Term Debt, Long-Term Operating Lease Liabilities, and Other Long-Term Liabilities follow the same rationale as the first Liability caption, but with another driver. This forecast was designed assuming no structural alterations in these line items.

WACC

WACC, or Weighted Average Cost of Capital, is the rate at which Cash Flows will be discounted further on in this Equity Research paper. The Weighted Average Cost of Capital is, as its name duly states, is the after-tax overall cost of capital, in average. It is used for investors to determine how much they require a company to perform in order to gather the best possible return, that is, how much return they demand of the firm's investments, being often seen as a "hurdle rate". In this instance, it will be used to predict NVIDIA's Net Present Value (NPV).

Concluding, Weighted Average Cost of Capital is computed by multiplying cost of equity and cost of debt by their respective weights and summing them up. Therefore, the appropriate analysis of NVIDIA's Capital Structure will be done, that is, how much it is financed by equity and debt and also address how much each financing option costs in order to correctly compute WACC, thus guaranteeing a sound and complete examination for prospective investments in NVIDIA (all values were last updated on 18th December 2023).

- Cost of Equity

The first topic that was addressed within Weighted Average Cost of Capital computations was Cost of Equity, which was a relatively straightforward calculus exercise. Initially, the correct

Figure 17: Regression of 5Y Daily Returns with S&P500

OLS Regression Results

Dep. Variable:	NVIDIA	R-squared:	0.507
Model:	OLS	Adj. R-squared:	0.506
Method:	Least Squares	F-statistic:	1288.
Date:	Mon, 18 Dec 2023	Prob (F-statistic):	1.06e-194
Time:	17:09:18	Log-Likelihood:	2960.0
No. Observations:	1257	AIC:	-5916.
Df Residuals:	1255	BIC:	-5906.
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	0.0016	0.001	2.460	0.014	0.000	0.003
S&P 500	1.7182	0.048	35.891	0.000	1.624	1.812

Omnibus:	375.972	Durbin-Watson:	2.058
Prob(Omnibus):	0.000	Jarque-Bera (JB):	5001.124
Skew:	0.999	Prob(JB):	0.00
Kurtosis:	12.565	Cond. No.	73.8

Source: Authors' Calculations

Market Risk Premium was searched, which is the rate of return when an investment as a certain degree of uncertainty involved (all that is not associated with the risk-free rate).

5% was the most accurate and updated value found for the Market Risk Premium, based on reviewed literature⁷. The Risk-Free Rate was obtained from a 10-Year Treasury Bond⁸, at valuation, originating the value of 3.95%. Finally, a regression of NVIDIA's past five years' daily returns with those of S&P500 was performed, using Python, giving an Equity Beta value of 1.7182 (Figure 17). By multiplying the above Beta with the mentioned Market Risk Premium, and then summing up the Risk-Free Rate, a Cost of Equity of 12.55% was obtained.

■ Cost of Debt

After Cost of Equity was duly computed, a Cost of Debt analysis followed. It is noteworthy that NVIDIA has S&P Credit Rating of A⁹. Regarding Yield-to-Maturity, which is the return rate bond investors can expect if the investment is to be carried out until term/maturity, it was obtained through a Corporate Bond from NVIDIA (maturity in 2031)¹⁰, and Yield-to-Maturity is 4.35%.

Furthermore, NVIDIA's probability of default, that is, how likely the borrower is to fail a certain debt payment, was established at 0.75%, due to its "A" Credit Rating, according to reviewed literature. Additionally, the company's recovery rate (estimated level of payback in case of default or bankruptcy) was put at 40%, due to the level of probability of default previously described.¹¹ With all this data, it was possible to compute the Pre-Tax Cost of Debt (subtracting the multiplication of the probability of default by one minus the recovery rate from the yield-to-maturity), which is 3.90%. Then, excluding the portion related to marginal tax (21%), a final Cost of Debt of 3.08% was gathered.

■ Capital Structure

Having concluded all computations concerning Cost of Equity and Cost of Debt, NVIDIA's Capital Structure assessment was performed, which entailed uncovering how much of the firm's financing is obtained through Debt and Equity (sum must be equal to 100%). The firm's Market Capitalization corresponds to NVIDIA's shares outstanding times the market value of stock, whereas the Market Value of Debt refers to the market value of NVIDIA's Corporate Bonds.

Furthermore, using equity and debts' weights in terms of firm value and Cost of Debt and Equity, it was possible to get the final figure for Weighted Average Cost of Capital, which is 12.46%, per the obtained results.

DCF Analysis

Moving on from the Weighted Average Cost of Capital, a Discounted Cash Flow analysis was performed. A Discounted Cash Flow analysis assumes that all future cash flows discounted with the investor required rate of return is the method to value a firm (NVIDIA, in this case).

⁷ Source: Goedhart, M., Koller, T., Wessels, D., "Valuation: Measuring and Managing the Value of Companies", McKinsey & Company, p. 237.

⁸ Source: Retrieved on 18th December 2023, from: <https://finance.yahoo.com/quote/%5ETNX?p=%5ETNX>

⁹ Source: S&P Global Ratings Credit Research.

¹⁰ Source: Retrieved on 18th December 2023, from: <https://markets.businessinsider.com/bonds/finder?borrower=111142>

¹¹ Common industry benchmark for the level of probability of default.

Its forward-looking nature enables a less limited application of forecasting, and its focus on cash flows rather than earning allows for a better metric in terms of value creation, as a higher Return on Invested Capital is not necessarily present in earnings. To accomplish this, every yearly change in Core Invested Capital was subtracted from the yearly Core Result in order to obtain the values for the Free Cash Flows. Only then was it possible to discount every Free Cash Flow by the previously computed Weighted Average Cost of Capital of 12.46%, generating the figures for the Discounted Free Cash Flows from 2025 on.

Afterwards, when all Free Cash Flows are appropriately discounted, the Terminal Value can be computed, which assumes a going-concern perspective in forecasting situations (in this case, perpetuity). Once computed, its present value should be uncovered, thus obtaining the Core Value. Moreover, the sum of this Core Value with the Non-Core Value, which was previously gathered when forecasting Financial Statements, gives us NVIDIA's Enterprise Value, leading to an Equity Value prediction for the firm. To conclude, an estimated price of 560.82\$ was reached for the firm's stock.

Long-Term Value Drivers

As previously done with the original items from the Financial Statements, an examination of what the value drivers were took place, particularly for the long run. Core Business grew almost annually throughout the analysed period, except for 2022, when it decreased significantly. However, it registered a tendency to stabilize from 2025 onwards. Considering total business, NVIDIA, was strongly influenced by its core operations, with the trend defined by the latter directly impacting total growth.

Market Value of Stock

NVIDIA has registered a wildly aggressive, unprecedented growth in its stock value over the last months. On the 18th December 2023, the chosen date for the last update, the stock closed at 500.77\$¹². This topic will be readdressed further on when a final recommendation to investors is given.

Sensitivity Analysis

A sensitivity analysis aims to provide and quantify the changes in output if something were to happen or impact one of its drivers. In this particular instance, a sensitivity analysis of the Discounted Cash Flow analysis was performed, through prospective variations in Weighted Average Cost of Capital and the Growth Rate in Perpetuity and their impact on the Terminal Value of the firm.

It was concluded that when the Growth Rate in Perpetuity increases, the Terminal Value follows the trend set by the former (Figure 18). However, when the Weighted Average Cost of Capital grows the opposite movement occurs in the Terminal Value, as it decreases. This were expected events, given the way Terminal Value was formalized. Nevertheless, it is noteworthy that, when both increase simultaneously by the same percentage points, Terminal Value tends

Figure 18: Sensitivity Analysis of WACC with Growth Rate in Perpetuity

		Growth Rate in Perpetuity (g)				
		2.34%	2.84%	3.34%	3.84%	4.34%
WACC	11.46%	\$593.29	\$617.38	\$644.43	\$675.03	\$709.93
	11.96%	\$555.86	\$576.78	\$600.12	\$626.34	\$655.99
	12.46%	\$522.27	\$540.54	\$560.82	\$583.44	\$608.85
	12.96%	\$491.98	\$508.02	\$525.73	\$545.39	\$567.32
	13.46%	\$464.53	\$478.68	\$494.24	\$511.41	\$530.47

Source: Authors' Calculations

¹² Source: Retrieved on 18th December 2023, from: <https://finance.yahoo.com/quote/NVDA?p=NVDA>

to decrease steadily, which means that Weighted Average Cost of Capital indeed holds more significance and can impact more severely Terminal Value than the Growth Rate in Perpetuity.

Final Recommendation

Considering all available data, both of NVIDIA and its peers, AMD, and Intel, a BUY position for NVIDIA is recommended.

Given all inquiries, computations and analysis performed throughout this equity research, it was concluded that NVIDIA's projections are above the prices over the last weeks, in average.

Furthermore, the estimated price for NVIDIA's stock, which was 560.82\$ surpasses that of 18th December 2023, at close, which was 500.77\$.

Being that it is a sector with a tremendous potential for innovative products and great estimated evolution in revenue over the coming decade, this is the right time to be at the forefront as an investor. Among its peers, NVIDIA is the one that stands out due to the synergies that can be created between segments, as its GPUs can complement the Artificial Intelligence assets pertaining to the company and even to others, as the AI Boom will last, with OpenAI, Google and Microsoft as important players in the market.