A Work Project, presented as part of the requirements for the Award of a Master Degree in Finance from the NOVA – School of Business and Economics.

NVIDIA – BUILDING THE FUTURE OF TECHNOLOGY

Tomás Filipe Pinto de Almeida Borges
32075

A Project carried out on the Master in (Finance) Program, under the supervision of:

Francisco Martins

17/12/2021

Abstract

Founded in 1993, Nvidia has a fundamental role in technological development from video game Graphics Processing Units to powering the AI revolution. Considering Nvidia's growing importance and the fact it has quickly become one of the largest Market Cap companies in S&P 500, we conduct an Equity Research Report to obtain its Intrinsic Share Price for January 2023.
Nvidia's valuation was assessed through the Adjusted Present Value (APV) method. Using this method, we expect an Intrinsic Share Price of $285,52 and an annualized total return of 1,14% for Investors that hold the stock from January 2022 to January 2023. Therefore, a Hold position is recommended.
This current report is part of a more complete joint report and should be read as an integral part of it.

Keywords

Nvidia; Valuation; Finance; Equity Research.

This work used infrastructure and resources funded by Fundação para a Ciência e a Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, Project 22209), POR Lisboa (LISBOA-01-0145-FEDER-007722 and Social Sciences DataLab, Project 22209) and POR Norte (Social Sciences DataLab, Project 22209).

This report is part of the Nvidia: powering the next era of computing report (annexed) and should be read has an integral part of it.

NVIDIA CORPORATION

COMPANY REPORT

SEMICONDUCTOR

17 DECEMBER 2021

STUDENT: TOMÁS BORGES

32075@novasbe.pt

Nvidia - Building the Future of Technology

Strong outlook but expensive price limits upside for FY2023

- Our APV valuation indicates a FY23 price target of **$285,52 per share**, resulting in a HOLD recommendation and an upside potential of 1,39% from the market close share price of $281,61 as of December 13, 2021.
- **Nvidia's acquisition of Arm to SoftBank is pending approval.** Regulators with concerns over Nvidia creating barriers for their rivals to access key technology, but also due to national security concerns from the UK. FTC sued to block the acquisition.
- **Fast-growing Gaming population and increasing popularity** over Nvidia's cloud-based gaming platform, e-sports, streaming and RTX improvements. **Facebook's Metaverse presents opportunities in Professional Visualization** through Nvidia's Omniverse platform developments.
- **Strong sustainable demand from corporations for Data Center** applications such as AI, machine and deep learning, and data analytics. **$8B design win pipeline expected until FY2028 in Automotive**, with over 370 partners on Nvidia DRIVE, and transition from Infotainment to AVs. **New CMP product offering for the OEM & Others segment**, directed at cryptominers, as an attempt to shift abnormal demand from gaming GPUs to CMPs.
- **Solid Gross Margins during semiconductor shortage due to increasing ASPs**, however the continuation of a chip shortage could imply an accumulation of unmet demand and loss of potential revenues.

Company description

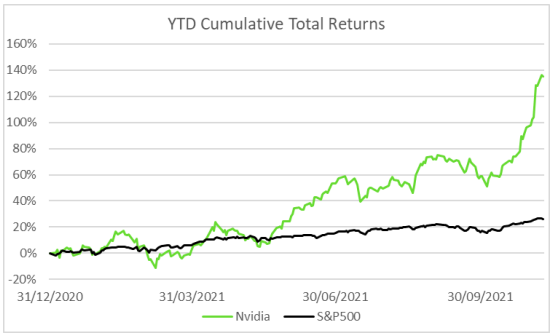
Nvidia is an American company operating in the semiconductor industry, specialized in the design and manufacturing of graphics processor units (GPUs), as well as system on a chip units (SoCs). Currently, Nvidia operates worldwide in four market segments: Gaming, Professional Visualization, Data Center and Automotive. Most recognizable product lines include the GPU GeForce series, Nvidia RTX / Quadro, DGX systems, and A series DC GPUs.

Recommendation:	**HOLD**
Price Target FY23[1]:	**285,52 $**
Price (as of 13-Dec-21)	**281,61 $**

Reuters: NVDA.O, Bloomberg: NVDA:US

52-week range ($)	115,67 - 346,47
Market Cap ($m)	704.025
Outstanding Shares (m)	2500
Beta	1,31

Source: Bloomberg, Analysts Estimates



Source: Bloomberg

(Values in $ millions)	FY2021	FY2022E	FY2023F
Revenues	16.675	25.994	36.643
Revenue Growth (%)	53%	56%	41%
EBITDA	5.630	10.040	12.357
EBITDA Margin (%)	34%	39%	34%
Net Profit	4.332	8.135	9.645
Net Profit Margin	26%	31%	26%
EPS	1,73	3,25	3,86
P/E	75x	87x	74x
ROE	27%	35%	32%
ROIC	32%	45%	40%

Source: Company Data, Analysts Estimates

Table of Contents

Company Overview

Brief History

Nvidia was founded in 1993 by current CEO Jensen Huang, Chris Malachowsky and Curtis Priem, three American electrical engineers, with the purpose of making microprocessors that would enhance full-motion video and generate better graphics for video games in PCs, a tool the founders believed to soon become a consumer device for enjoying games and multimedia.

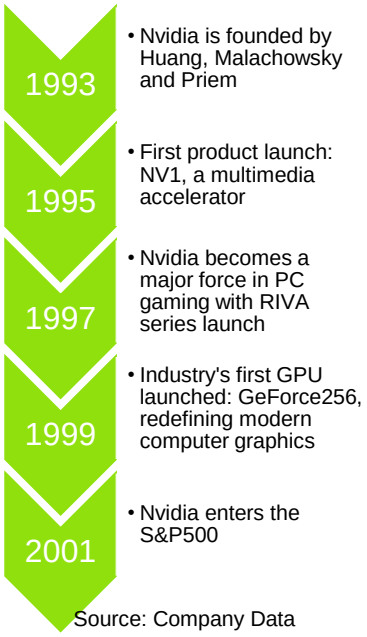
Just 2 years after its foundation, Nvidia launched its first ever product, the NV1, a multimedia accelerator capable of handling both 2D and 3D video, together with audio processing hardware. By 1997, Nvidia became a major force in the PC gaming industry, with the launch of the RIVA series of video cards.

In 1999 Nvidia launched the industry's first GPU[1], the GeForce256, paving the way to an unprecedented growth of the PC gaming market. The GPU redefined modern computer graphics, and revolutionized parallel computing, offering superior 3D graphics quality. As one of the fastest growing companies, it would enter the S&P500 by 2001. More recently, GPU deep learning ignited modern Artificial Intelligence with the GPU acting as the brain of computers, robots, and self-driving cars that can perceive and understand the world.

Nowadays, located in offices across 28 countries, with its HQ in Santa Clara, California, Nvidia presents itself as a global leader in the high-end GPU market, not only dedicated to PC graphics, but also focusing on opportunities arising from digital transformation, such as AI, data science, deep learning, Augmented reality (AR) and Virtual Reality (VR), and autonomous driving. Nvidia takes advantage of its platform strategy, a combination of both hardware and software tools, to enhance and optimize its GPU's performance, a key element in its value proposition.

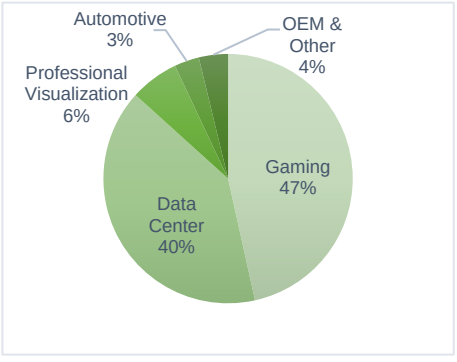
Innovation through research & development is crucial for the business model of the company, having invested over $24B in this department since inception, far more than its closest GPU competitor, AMD. This enables Nvidia to adapt to new market trends, while also providing new and superior products, a key factor for the company's success.

Exhibit 1: Nvidia's History timeline



Source: Company Data

Exhibit 2: Nvidia's FY21 Revenue weight per market segment



Source: Company data

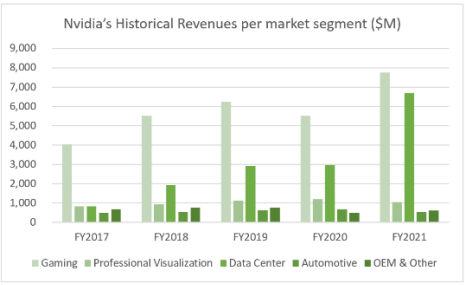
Segments and Products

Nvidia specializes and addresses its computing platforms towards four main market segments: Gaming, Professional Visualization, Data Center, and Automotive. Additionally, the company also includes the OEM & Others as additional segment in its financial reports.

Gaming:

[1] Graphics Processing Unit

Exhibit 3

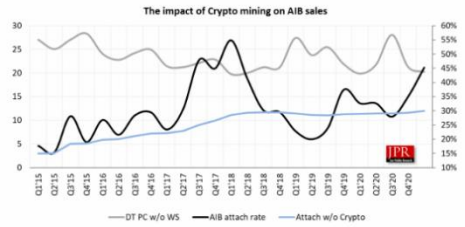


Source: Company Data

Exhibit 4: Nvidia GPU Architecture timeline

Source: Company Data

Exhibit 5:



The difference between DT PC w/o WS and AIB attach rate, represents the buying of GPUs by crypto miners.

*AIBs refer exclusively to graphics add-in boards which is the same as finished GPUs

Currently accounts for 46,5% of the company's total revenues (Exhibit 2), growing at a CAGR of 17,6% from 2017 to 2021 (Exhibit 3). The emergence of new gaming platforms, the popularity of eSports and changing demographics, together with the Covid-19 lockdowns, have all contributed to the growth of computer gaming, making it the largest entertainment industry. Nvidia serves this segment by providing GPUs that deliver the ultimate gaming experience for gamers with smoother and higher-quality graphics, together with a gaming application that optimizes the PC user's settings. Products offered include GeForce RTX and GTX GPUs for PC gaming, SHIELD devices for gaming and streaming and GeForce NOW for cloud gaming.

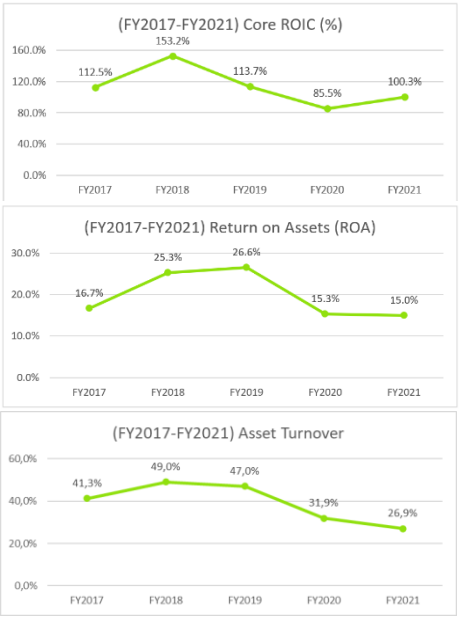
Nvidia's technological breakthroughs on GPU architectures have consistently been leading to improvements in processing power, allowing the company to continue excelling in the medium/high-end range. There is speculation on the next architecture line (Ada) using 5nm in its manufacturing process, versus the current 7nm and 8nm implemented architecture line (Ampere), which could imply up to 70% performance gain. While most information on this new architecture is still not made official by Nvidia, and it is not certain the release date will happen during 2022, it would result in a huge competitive advantage over its peers such as AMD, which uses a 7nm Navi architecture.

A great potential in this segment is cloud-based gaming, a type of online gaming that runs video games on remote servers and streams them directly to a user's device. This implies gamers no longer require a high-powered, expensive gaming PC to run games which, on one hand, could threaten Nvidia's retail physical GPU sales. On the other hand, this can increase the demand for Nvidia GPUs in data centers and server farms running the games, as well as allowing Nvidia to reach new consumers via its own cloud-based gaming platform. Currently Nvidia's 1 year old cloud-based gaming platform (Geforce NOW) is showing potential, with already more than 12 million users.

A relevant portion of the demand from this market currently comes from crypto miners (Exhibit 5). In the past years the portion of sales of gaming GPUs sold to crypto miners have been increasing, mostly fluctuating based on the performance of the cryptocurrency market (the crypto crash of 2018 put a stop to this trend until mid-2019), and now new highs of crypto prices are already being reflected in strong purchases of GPUs by cryptominers with 25% of GPUs sold in Q1 & Q2 of 2021 going to crypto[2]. To avoid Gaming GPUs being absorbed by crypto miners and potential shortages for the core gamer customer base, Nvidia implemented a new strategy of limiting hash rates[3] of its newest gaming GPUs (making them inefficient for cryptocurrency mining) and introducing a new line of CMPs[4] exclusive for cryptocurrency miners.

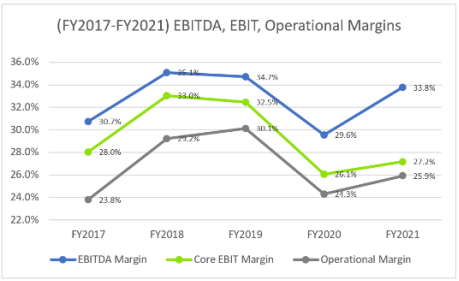
[2] Source: https://www.jonpeddie.com/blog/crypto-minings-half-a-billion-dollar-impact-on-aib-sales
[3] Hash rate is a measure of the computational power per second used when mining (the higher the hash rate level the more efficient mining is)
[4] CMPs (Cryptocurrency Mining Processors) function similarly to GPUs and are designed and optimised for mining cryptocurrency

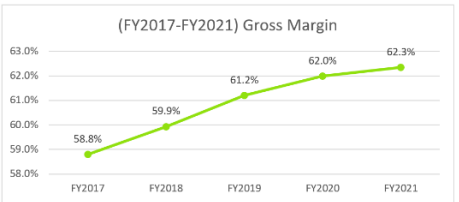
Exhibit 6: Nvidia's Profitability on Investments

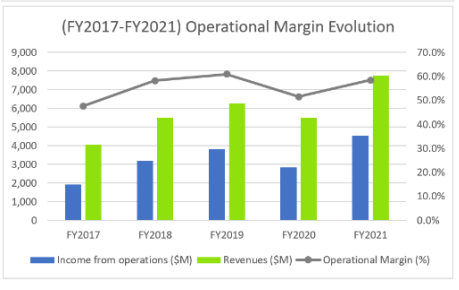


Source: Analysts Estimates

Exhibit 7: Nvidia's Core Profitability Margins







Source: Analysts Estimates

Professional Visualization (PV):

With a representation of just 6,3% of the company's total revenues (Exhibit 2), growing at a meagre CAGR of 6% from 2017 to 2021 (Exhibit 3), the PV market segment consists mostly of partnerships with independent software vendors to optimize software offerings for Nvidia GPUs, aiming to enhance productivity and introduce new capabilities for critical parts of the workflow for industries such as automotive, media & entertainment, architectural engineering, oil & gas, and medical imaging.

With the main users of this segments' products being designers who build products that aim to mirror reality, professional visualization relies on the demand for the creation of professional graphics, advanced rendering, video processing, material design, 3D printing and virtual reality applications.

Currently, a great strength in this segment is the fact Nvidia is providing graphics for more than 90% of workstations, which are high-performance computers (HPC) set to run complex tasks. Products offered include DesignWorks (software), Nvidia RTX, Nvidia Omniverse (a platform oriented for rendering hyper-realistic objects and environments which is used by giants such as Pixar and Adobe), and Quadro (a GPU line dedicated for workstations able to perform heavy-load designer tasks).

Data Center:

Data Center is Nvidia's most promising and highest growth market segment, with a staggering CAGR of 68,5% in the past 5 years (Exhibit 2). Data Center currently weights 40,2% of the company's total revenues, the second highest, behind Gaming (Exhibit 3). Recent revenue growth can be attributed to the effect of the Mellanox acquisition in FY2021 and the ramp up of the Nvidia GPU Ampere architecture.

Nvidia provides data centers the ability, through its computing platform, to accelerate deep learning, machine learning and perform high-performance computing, while prioritizing energy efficiency. This platform consists not only of hardware but also software and service tools like libraries, development kits, CUDA programming model and APIs frameworks, which complement and enhance GPU performance.

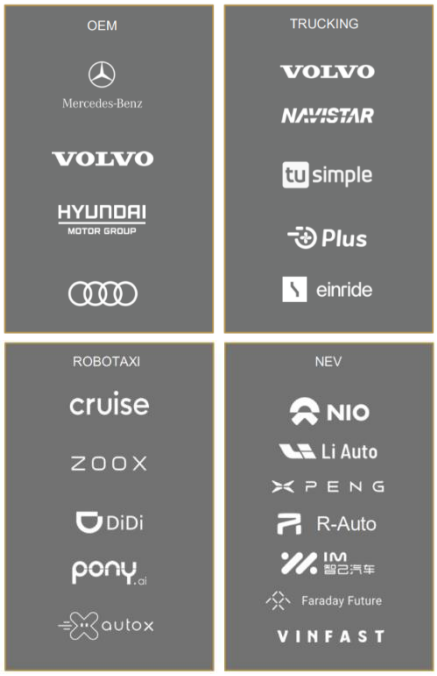
Nvidia's customer base for this market segment includes large data cloud providers such as Google Cloud, Azure, AWS and Alibaba. (Exhibit 8). Products in this segment include "Ampere" architecture GPUs (using the same architecture as gaming GPUs but made for heavier workloads and, as such, bet in the most recent generations of RT and Tensor Cores[5]), DGX (line of workstations and servers able to run heavy and complex machine learning and deep learning workloads on GPUs), Nvidia HGX A100 (Accelerated

[5] According to Nvidia RT Cores are accelerator units that are dedicated to performing ray-tracing operations with extraordinary efficiency. Tensor cores are processing units that accelerate the process of matrix multiplication (matrix multiplication is essential for graphics).

Exhibit 8: Nvidia's Data Center customer base

Source: Nvidia Investors Presentation

Exhibit 9: Nvidia's Automotive Partners



Source: Nvidia Investors Presentation

Exhibit 19.a: Porter's Five Forces' Impact on Valuation

Threat of New Market Entrants:
Profitability ↑
- ARPU ↑ *(Few incumbents)*
- Gross margins ↑ *(Economies of Scale)*
- Market Share ↑ *(Barriers to Entry)*

Computing Platform), Nvidia EGX (Cloud Platform), NGC (Hub of GPU accelerated software), Nvidia vGPU software.

Automotive:

This segment currently generates a humble 3,2% of total revenues (Exhibit 2), with a 5-year CAGR of 2,4% (Exhibit 3). Today, Automotive is largely a legacy infotainment business. However, the focus has been shifting towards AI cockpit and Autonomous Vehicles (AV). The company has been signing multiple partnerships with automakers, truck makers, suppliers, startups, etc. to develop AI systems for self-driving vehicles. Most noticeable names include Volvo, Mercedes-Benz, and Toyota (Exhibit 9). Nvidia has a design win pipeline for this segment of over $8B for the next six years, and the firm expects it to ramp up in FY2023, reflecting the development of AV solutions.

Products in this segment include Nvidia DRIVE collection (AGX Pegasus, AGX Xavier, Atlan, Hyperion) which contains hardware offers able to process data from cameras, radars, and sensors, to perceive environments, locate a car on a map, plan and execute a safe path, and software products (Drive OS, DriveWorks, Drive AV, Drive IX).

OEM & Others:

A segment that includes all products outside the Gaming, Data Center, Professional Visualization, and Automotive segments, generates 3,8% of total revenues (Exhibit 2), with a 5-year CAGR of -2,5% (Exhibit 3).

OEMs are products identical to GPUs, but they are designed for selling to equipment manufacturer: buyers of OEMs are computer builders (such as Dell or Lenovo) who sell operational computers to customers in versions. OEMs are unfinished products (in the sense they often lack accessories, boxes, or other features) and not suitable to sell directly to final customers. This product has been the core of the OEM & Others segment, but over the years Nvidia has been divesting on the OEM business leading to the segment's decrease in revenue.

A new product line in this segment that offers new opportunities for revenue growth are CMPs. Designed to meet cryptominers' needs and intended to segment them away from Gaming products, which are seen as substitutes for mining cryptocurrencies.

Industry Overview

Porter's Five Forces Analysis

To analyze the semiconductor's industry profitability, and understand the main sources of competition and attractiveness, we conducted a Porter's Five Forces Analysis.

Threat of New Market Entrants: Low

This industry presents strong barriers to entry which make the threat of new entrants low. Firstly, a large amount of CAPEX is required to operate in this industry (except for fabless

manufacturing such as Nvidia), not to mention the high R&D investments required and difficulty in obtaining economies of scale due to constant evolving technology. Other factors include product differentiation (even in products serving the same end), strong patents, licensing, and regulation.

Supplier Power:
Profitability →
- Switching Costs ↓ *(Standardized Supplies)*
- Cost of Sales ↑ *(temporary supply shortage)*

Supplier Power: Medium

There are many suppliers in this industry. Despite a large share of TSMC (Taiwan Semiconductor Manufacturing Company) supplying the incumbents of the GPU industry, the products offered by suppliers are mostly standardized (low differentiation and low switching costs). It is unlikely suppliers could forward integrate. In the case of Nvidia, they are a strong customer, therefore making the bargaining power of suppliers lower and forcing them to compete in prices. Nevertheless, the recent semiconductor shortage is causing GPU manufacturers inability to produce as much as required to meet their demand, and the growing urgency for semiconductors is providing their suppliers with much more bargaining power than in pre-shortage times.

Buyer Power:
Profitability ↓
- ARPU ↓ *(price sensitivity)*
- Market Share ↓ *(Large Buyers lead to competitive action)*
- Operating Expenses ↑ *(Differentiation through R&D)*

Buyer Power: Medium/High

Most buyers in this industry are retailers who will then sell the products to final customers, except in the case of software and products for companies, which are final customers. Overall, there is some differentiation in this industry: while most buyers can interchange between GPUs from different companies, there are often unique architectures and exclusive features that differentiate brands, e.g. the case of Nvidia GPUs with RTX providing exclusive access to DLSS 2.0 in videogames, unobtainable from other GPU brands. An important buyer power factor is price pressure from final consumers (households who have limited buying power to allocate in entertainment) as they aim to buy the best offerings available by paying the minimum possible price. Another factor that increases buyer power is the concentration of large portions of revenues in few buyers. Even leaders such as Nvidia and AMD have at least 1 buyer who is responsible for more than 8% of revenues. Therefore, price pressures, order cancellations or main customers switching to competitors could pose a serious threat. Regarding potential backwards integration, it is highly unlikely. Nvidia's investment in innovation and differentiation will be a relevant factor to tackle buyer power threats.

Source: Analysts' authorship

Threat of Substitutes:
Profitability ↑
- Penetration Rate ↑

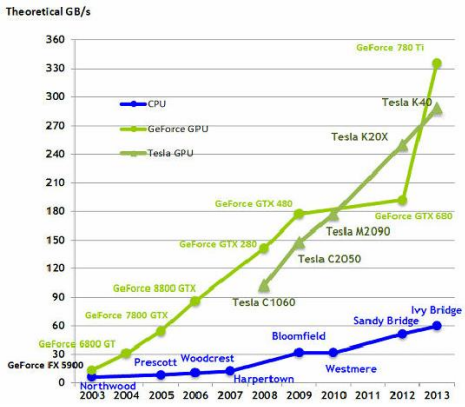
Threat of Substitutes: Low

There are no substitutes to products such as GPUs. While a CPU can replace a GPU in theory, it is extremely limited and, in the modern day, GPUs are necessarily required to perform certain computational tasks (Exhibit 20). Nevertheless, we should not exclude the risk of emerging new technologies that could jeopardize GPUs and be protected by patents.

Competitive Rivalry:
Profitability ↓
- Market Share ↓ *(Higher Competitive Action Likelihood)*
- Operating Expenses ↑ *(Innovation driven rivalry)*

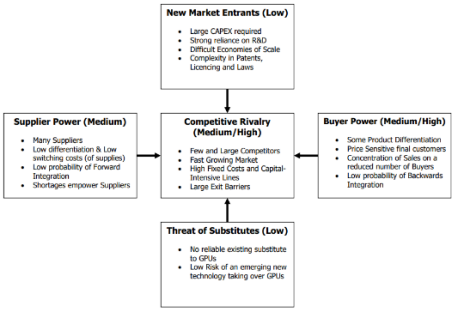
Competitive Rivalry: Medium/High

Exhibit 20: CPU vs GPU performance



Source: Ragel and Elkaduwe https://www.researchgate.net/publication/270222593_To_Use_or_Not_to_Use_Graphics_Processing_Units_for_Pattern_Matching_Algorithms

Exhibit 19.b: Porter's Five Forces' Diagram



Source: Analysts' authorship

There are few competitors in the industry Nvidia operates in, with most of them being large companies. The companies involved in this industry have historically competed to gain market share, but the fact this industry is growing at a fast pace means competitors are less likely to engage into competitive actions to take established market share from each other, instead focusing more in aggressively capturing the new portions of the market and expand to different segments. The somewhat differentiated products within the companies also make firms less prone to competitive actions. High fixed costs, such as the case of the factories, which are extremely expensive to build due to state-of-the-art technology, and short lifespan of equipment increases rivalry. Although companies like Nvidia outsources most operations but design and software development, the very specialized manufacturers they outsource to have capital-intensive production lines (in very specialized factories), and often forces GPU companies like Nvidia to increase capacity by large steps. Furthermore, events such as overproduction could force companies to take competitive action to adjust their supply-demand, as unsold products can quickly lose their attractiveness to more recently released models. Lastly, the vast exit barriers within this industry due to high amounts of "inadaptable" required capital and R&D and fixed costs, as well as exit legal implications, make competition fiercer.

Conclusion

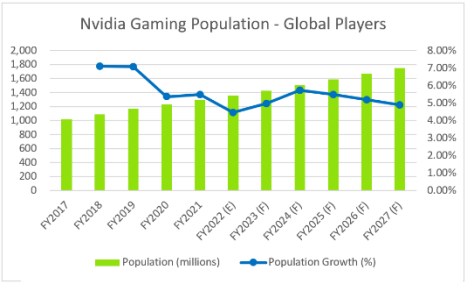
Overall, the forces in this industry tend to be strong, which proves challenging for Nvidia to sustain greater levels of profitability. Nvidia must remain updated in technological innovation and be able to maintain consistent quality and competitive prices, otherwise a competitor who brings new products, with better affordability, better performance or additional features could undermine Nvidia and conquer market share. We believe Nvidia's best chance of maintaining its current competitiveness and profitability levels within this sector are by keeping their current platform strategy, a crucial piece for its value proposition, and continuing to innovate and exploring different markets. The valuation impact of the forces was considered in our forecasts, especially in the Value Drivers and Forecasts assumptions, for which Market Share, Penetration Rate, and ARPU mostly reflect the impact of the forces, naturally other elements such as Operating Expenses (case of R&D) and Cost of Sales also consider P5Fs in their forecasts.

Valuation

Value Drivers and Forecast assumptions

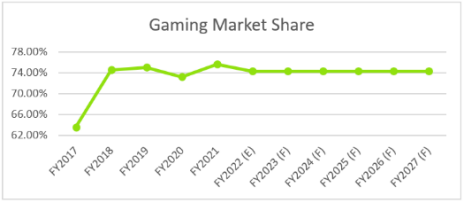
To forecast revenues for each segment we rely on the method based on the equation: **Revenues = Population x Penetration Rate x Market Share x Average Revenue per User (ARPU)**. We found this to be the best way of accurately estimating Nvidia's future revenues given the available data provided. For FY2022 estimate we took the liberty of

Exhibit 30:



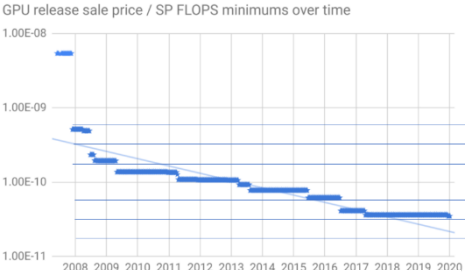
Source: Analysts forecasts

Exhibit 31:



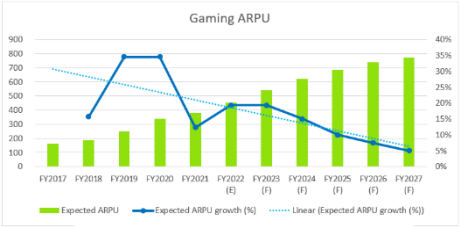
Source: Analysts forecasts

Exhibit 32:



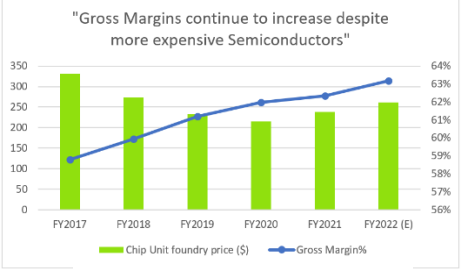
Source: AI Impacts
https://aiimpacts.org/2019-recent-trends-in-gpu-price-per-flops/#Release_date_prices

Exhibit 33:



Source: Analysts forecasts

Exhibit 34:



Source: Analysts forecasts

incorporating actual quarterly data in our forecast. Nevertheless, even though 75% of this year's figures are based on real data, we still treated it as an estimate.

Revenues

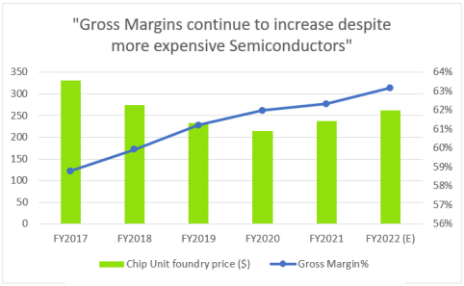
Gaming Segment

Gaming revenues are greatly driven by the rising gaming population numbers (CAGR of 5.74% expected until 2023F). Nvidia also demonstrates solid evidence of having capabilities to solidify its market share close to 75%, namely in gaming platforms such as Steam, Epic Games Store, and GOG, if it keeps leveraging its differentiating technologies such as RTX and DLSS 2.0. Furthermore, if it continues the trend for innovation in the long run, it will maintain its advantage over competitors' strategic advances, such as Intel's "Alchemist" upcoming GPU line to compete in gaming.

ARPU is expected to evolve according to the market's most competitive GPU release price divided by its total flops[6], allowing us to plot a cost metric ($ per flop) against the evolution of total flops of Nvidia's most recent possible GPU line. While the dataset used has the limitation of relying on release prices (Nvidia's main sales come from selling to retailers and not to the final customer directly), we are assuming release prices are very much in conformity with the manufacturer's suggested retail price (MSRP). Furthermore, the dataset contains a high sample of GPUs and a single measure of performance which allows for comparisons: Flops at single precision[7]. Overall, we concluded that despite performance becoming cheaper over time for Nvidia GPUs ($ per flop decreases), the computing speed improvement in GPUs has been even greater (flops per GPU grows faster than $ per flop decrease), making GPUs indeed more expensive over time for customers (especially in the early 2010s). Besides assuming this trend into the future, we reinforce it with the belief that, as long as the semiconductor shortage lasts, Nvidia will be able to dictate demand from its supply by practicing higher prices, which so far has been one of the main reasons Gross Margins have kept increasing through the shortage (Exhibit 34). We assume an average user will change GPU every four years into the future, a variable mostly defined by factors such as innovation speed, retail prices changes, and consumers' buyer power. While GPU prices continue to soar amidst the semiconductor shortage, something which could push lower-purchasing power users away from replacing their GPU every 4 years on average, we reject this hypothesis because, on average, 71%[8] of gamers increased their time spent playing games during the covid-19 pandemic, which contributes to the wear and tear of their GPUs in the medium-long term.

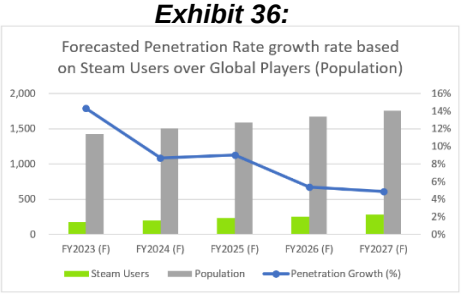
[6] A flop (floating point operations per second) is a measure of computing performance.
[7] Single-precision floating-point format (known as FP32) is a computer number format, usually occupying 32 bits in computer memory.
[8] Barr M, Copeland-Stewart A. Playing Video Games During the COVID-19 Pandemic and Effects on Players' Well-Being. Games and Culture.

Exhibit 35:



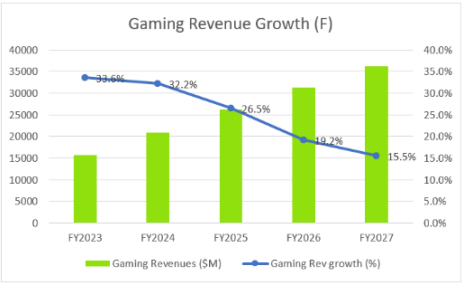
Source: Analysts forecasts

Exhibit 36:



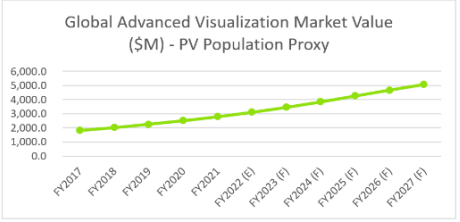
Source: Analysts forecasts

Exhibit 37:



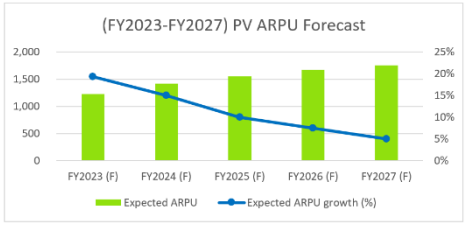
Source: Analysts forecasts

Exhibit 38:



Source: Analysts forecasts

Exhibit 39:



Source: Analysts forecasts

In terms of penetration rate, evidence suggests more global players use computer-based platforms (led by Steam, with an average of 120 million active users in FY2021) which involve the need of dedicated GPUs or a subscription to cloud-gaming platforms[9]. With the rise of cloud-gaming easing access to high graphics games, we expect a growth in penetration rate, given by steam users over total PC gamers, of +15.67% in FY2022 and +14.31% in FY2023. The growth rate is expected to steadily decrease towards +4.43% by FY2030, as cloud-gaming should shift from the Growth to Maturity product cycle by then. Lastly, this forecast also takes into account ongoing threats such as the Chinese Communist Party restricting gaming to 3 hours per week which negatively impacts the penetration rate. It is important to point out that China is the largest video-game market, responsible for 23.3% of total Nvidia sales (reported in FY2021) and is the most populated country in Asia (a continent with 54% of worldwide gamers) with one of the fastest growing consumers purchasing power.

Professional Visualization Segment

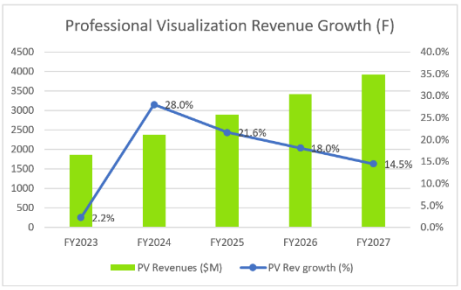
PV revenues are highly driven by the size of the Global Advanced Visualization market, which is expected to grow at a CAGR of 11,3% until FY2024. As this market matures in the future, its growth will slowly deteriorate and converge to the real long-term GDP growth of 2,2% annually in the steady state.

In terms of Market Share, we expect Nvidia to maintain its current 90% share. Competitors, and Nvidia alike, have solid expectations that the firm's current share in graphics for workstations will most likely continue in the future as they have a well-established line of GPUs (Quadro) and software in professional graphics, advanced rendering, video processing, material design, 3D printing and virtual reality applications, while showing capabilities of innovating and making strong new offerings. Furthermore, as mentioned, Nvidia is the company of choice for Metaverse which shows potential of becoming a key product in the Global Advanced Visualization market. Currently, AMD and Xilinx, the only apparent competitors in this market, seem to lack capabilities and have only been able to develop residual products to compete with Nvidia in this segment.

ARPU for this segment, similarly to Gaming, was based on the evolution of $/flop against the number of flops for the new GPU lines. PV focuses on providing graphics mostly to workstations and HPCs set to run complex tasks. Therefore, we apply the evolution of our wider GPU ARPU growth on a higher-end range of GPUs and considered a lifespan of 3 years due to two main factors: **a)** Faster depreciation in complex and demanding professional environments for such GPUs; **b)** Higher reliance on top of the line technology by professionals, incentivizing them to upgrade GPUs more often.

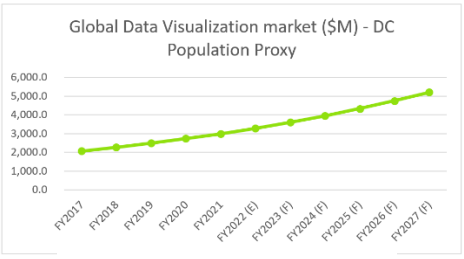
[9] Users of Cloud-Gaming platforms do not require a dedicated GPU on their computers – the only requirement is solid internet connection as a server with all the necessary dedicated hardware (including GPUs) runs the videogames and streams to users in real time.

Exhibit 40:



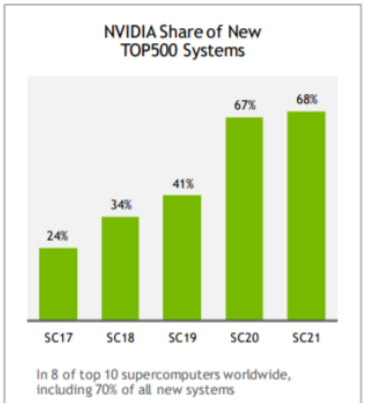
Source: Analysts forecasts

Exhibit 41:



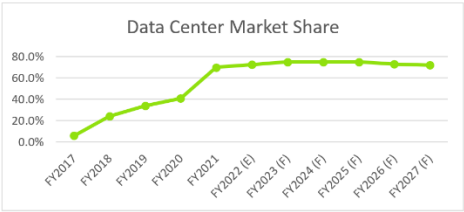
Source: Analysts forecasts

Exhibit 42:



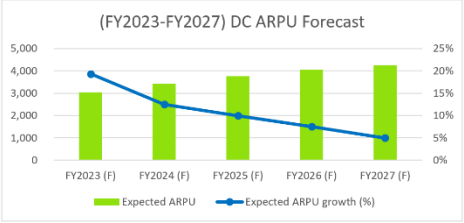
Source: Nvidia Investors Presentation

Exhibit 43:



Source: Analysts forecasts

Exhibit 44:



Source: Analysts forecasts

Since this segment serves a professional setting, users can't often delay GPU upgrades if they intended to keep performing the most innovative tasks, therefore we expect them to be little price sensitive and still buy on a regular frequency amidst higher prices caused by the semiconductor shortage. We expect an ARPU with a CAGR of +19.36% in FY2023, followed by a slowdown in 2024 to +15.0% (end of shortage expected).

We reinforce Metaverse as a key opportunity for revenue growth: as Facebook rebrands, they are going to adopt the Metaverse (a shared virtual platform through which people move through digital environments and can access anywhere from different devices). The size of the project[10] should accelerate the Global Advanced Visualization market, hence the optimistic CAGR of 11,3% until FY2024. Nvidia's Omniverse has the right capabilities for implementing in Metaverse: it allows for projects like creating simulations of real-world buildings (e.g., houses) and assets such as avatars which are necessary to build the core of metaverse. With the right infrastructure and capabilities Meta requires, it is almost certain Facebook's future Metaverse will rely on Nvidia's products[11], and reinforce Nvidia's leadership in this market with the market share of 90%.

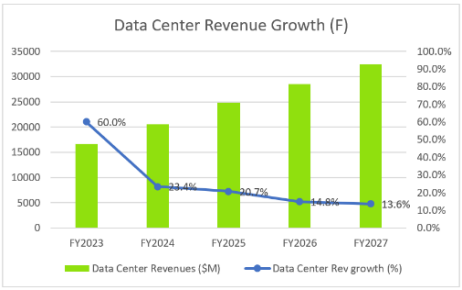
Datacenter Segment

Data Center Revenue predictions were based on the Global Data Visualization market as proxy for population. Since most activities related to data centers (AI, data analytics, graphics, scientific computing, etc.) rely on data visualization to deliver what we could call the "end product", whether data visualization is used in the context of delivering results to customers or help professionals extract value from data, this market proxy reflects the growth in demand for this segment. With Artificial Intelligence quickly gaining a central role in society, we expect a CAGR of 9,69% until FY2027.

In terms of market share, we used the Nvidia share of New TOP500 systems (Exhibit 42). These systems are used for a wide range of computationally intensive tasks, and have grown in importance in data related tasks, especially since Machine Learning, and more recently Deep Learning, have been gaining popularity among companies with large amounts of data. Nvidia has made solid progress in gaining representation in TOP500 Systems, which are exclusive to high scale HPC and provide a good overview of the firm's Data Center (DC) segment presence for companies using top technology. Although Nvidia made it to 70% representation in mid-2021, capturing 36% of the share of TOP500 computers in just 2 years, with the aid of the Mellanox acquisition, competitors are hard to eliminate and market share difficult to hold, as we have proven in the P5F analysis. Therefore, we expect market share to reach a peak of 75% in FY2023, following the new Grace CPU release, but we consider that, as the market matures, competition

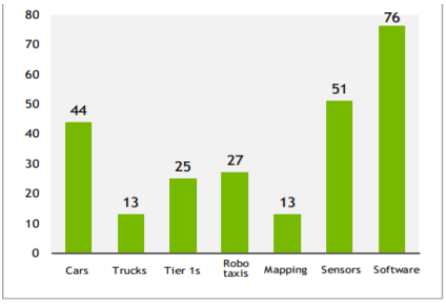
[10] Source: https://www.fool.com/investing/2021/12/14/question-determine-future-of-30-trillion-metaverse/
[11] Sources: https://www.marketwatch.com/story/this-is-how-nvidia-plans-to-make-lots-of-money-from-the-metaverse-11637246368
https://www.bloomberg.com/news/articles/2021-11-01/is-the-metaverse-really-going-to-happen-nvidia-nvda-says-yes

Exhibit 45:



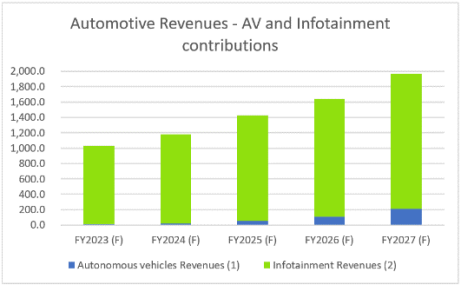
Source: Analysts forecasts

Exhibit 46:



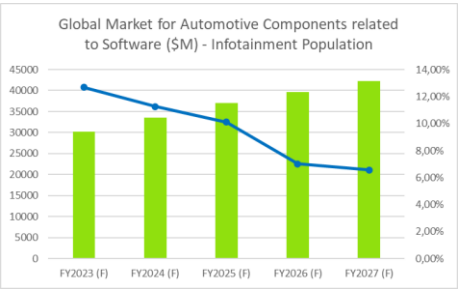
NVIDIA DRIVE Partners
Source: Nvidia Investors Presentations

Exhibit 47:



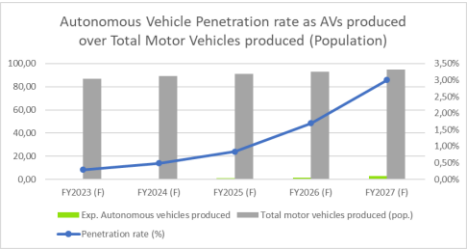
Source: Analysts Forecasts

Exhibit 48:



Source: Analysts forecasts

Exhibit 49:



Source: Analysts forecasts

will retract Nvidia's market share to a generous 65%. Limiting Market Share at 65% also comes in line with the ARM acquisition almost certainly being blocked: ARM possesses solid capabilities centered around Datacenter CPU technology and without the acquisition competitors can still have access to its technology and maintain their edge over Nvidia in CPU offers.

Just like in the Gaming and PV segments, the ARPU estimations are based on the evolution of $ per flop against the number of flops for the new GPU lines. We apply that evolution to a price average of recent DC GPU offers (such as the A100, A10, A16, A30, among others), which are top of the line and carry more features than those used for PV workstations and HPCs, in order to perform DC specific tasks. We expect a CAGR of +19.36% in FY2023, followed by a slowdown in 2024 to +15.0% (end of shortage expected).

Automotive Segment

Automotive revenues are expected to grow in two fronts: Infotainment and Autonomous Vehicles (AV). Most of the segment's revenues come from infotainment: systems that run all the communication and entertainment functions of a car, from phone calls and navigation to music and sometimes even films. The current weight of Avs in this sector is barely relevant, but the future of autonomous chips and SoCs could prove a good revenue source for Nvidia if it steps up on its hardware and software offers, such as those included in the Nvidia DRIVE collection, which seems to be the case if we look at the rising number of Nvidia's partnerships with car manufacturers.

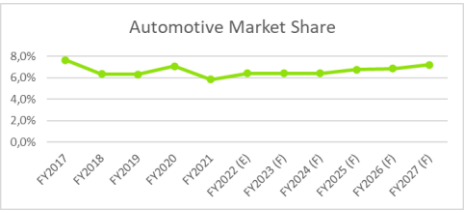
As the population proxy for infotainment, we rely on the Global Market for Automotive Components related to Software, which is expected to more than double until 2030, while for AVs we rely on total motor vehicles produced annually (87 million expected for 2027).

Since we expect AV revenues to grow in line with the production of AV vehicles, which could reach an annual output of 12,16 million by 2030, and considering the total motor vehicles produced population, which we expect an annual production of 101 million by 2030, the penetration rate[12] of AVs should be 12% in that year.

In terms of Market Share, Nvidia has struggled to grow in the past, with just 6,3% of the market's revenues in FY2020. Nevertheless, we expect this value to revert to the mean of the past years in our forecast (towards 6,7%) since, despite solid competition in the sector, Nvidia's increasing partnerships are working as a catalyst to improve its market share. Nevertheless, a pattern common to semiconductor producers in the automotive market is each having specific products for specific ends, and if Nvidia focuses on solidifying its position on niche offers for Avs (as it already did with infotainment), it could mitigate competitive pressure. As we said, Nvidia's acquisition of Arm Limited would be

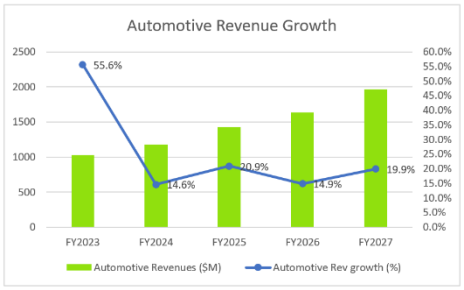
[12] Penetration rate = Target population / Total population. In this case, AV output / Total motor vehicle output

Exhibit 50:



Source: Analysts forecasts

Exhibit 51:



Source: Analysts forecasts

Exhibit 52:

NVIDIA Hardware Hash Rates

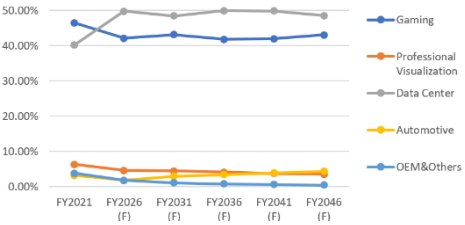
AnandTech	Hash Rate	Power	Efficiency MH/s/W
RTX 3090	121 MH/s	290 W	0.42
RTX 3080	98 MH/s	224 W	0.44
90HX	86 MH/s	320 W	0.27
RTX 3070	62 MH/s	117 W	0.53
RTX 3060 Ti	60 MH/s	120 W	0.50
RTX 2080 Ti	49 MH/s	240 W	0.20
50HX	45 MH/s	250 W	0.18
40HX	36 MH/s	185 W	0.19
30HX	26 MH/s	125 W	0.21

HX Data from NVIDIA
RTX Data from Minerstat

Source: Nvidia and Minerstat

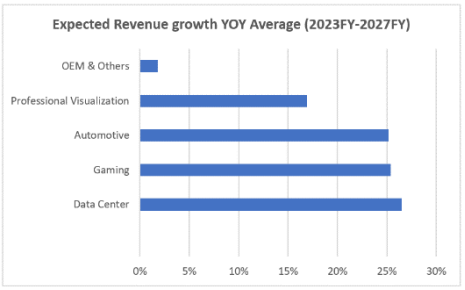
Exhibit 53:

Revenue Distribution per segment FY2021-FY2046



Source: Analysts forecasts

Exhibit 54:



Source: Analysts forecasts

a determinant factor to consolidate market share, as it contains all the capabilities necessary regarding semiconductors used for automotive advanced driver-assistance systems and infotainment. Nevertheless, the likelihood of the acquisition is virtually null.

Although Nvidia expects the $8b design-win pipeline for Nvidia Drive to ramp up in FY2023 until FY2027, our estimates show it will take until FY2028 for these $8 billion to materialize in revenues for the automotive segment, due to our more conservative assumptions regarding the production level of AVs, and the neglecting of Arm's acquisition boosts for the segment.

OEM & Others Segment

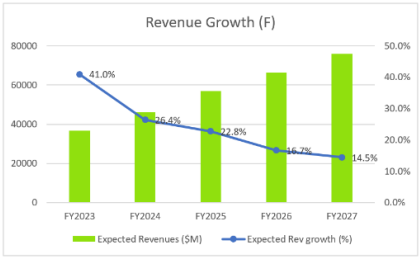
OEM & Others reached its peak sales in FY2018 (with $777 million), and since then it had the fastest decrease in weight contribution to total sales. As mentioned, Nvidia is divesting in OEMs and also plans to make CMPs the core product of this segment to better segmentate customers and control the demand shocks for gaming GPUs. Part of the strategy consists in making CMPs more efficient at mining than gaming GPUs (such as having better power efficiency, smaller size, and better airflow) while also limiting Hash Rate capabilities of new Gaming GPUs to limit their mining efficiency (Exhibit 52).

In terms of CMPs, demand is expected to depend on the profitability of mining cryptos[13] such as Bitcoin (BTC), which holds the #1 popularity and largest market cap of all digital currencies. Over time, computing power increases (measured in hash rates for cryptomining), and new systems mine more cryptocurrencies, which are important profitability factors, along with others such as electricity consumption costs, transaction fees, hardware costs (e.g., CMPs), and crypto prices, obviously. Given factors such as: **a)** rising popularity of mining pools; **b)** increasing number of product launches Nvidia aims to have in the context of global cryptocurrency mining hardware market; **c)** shift of cryptominers from gaming GPUs to CMPs; we assume CMP sales to grow at a CAGR of 5% until FY2026. Although, the market for CMPs has an interesting potential, we cannot exclude the fact other GPUs can still replace CMPs, and strategies such as hash rate limiting of gaming GPUs are still fallible, as seen by recent hash rate hacks, for which cryptominers are able to remove the imposed limits. For these reasons, we place Nvidia's CMP sales growth ~2,85% below the expected CAGR for the crypto mining hardware market for the period in question.

In terms of the remaining segment excluding CMPs, we expect Nvidia to continue divesting in OEMs, as stated by Nvidia itself. Overall, the segment should recover slightly from past years due to the CMP focus, nevertheless it should continue its trend of losing weight contribution to total sales when compared to other segments (Exhibit 53).

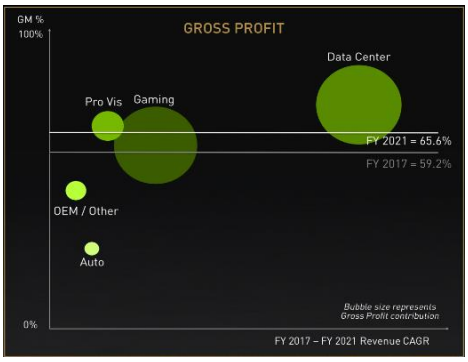
[13] In short, crypto mining of BTC (bitcoin) is a process for which cryptominers verify transactions in the blockchain and receive BTC as a reward after solving a puzzle to ensure the authenticity of the transaction.

Exhibit 55:



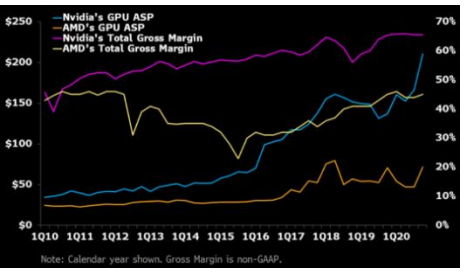
Source: Analysts forecasts

Exhibit 56:



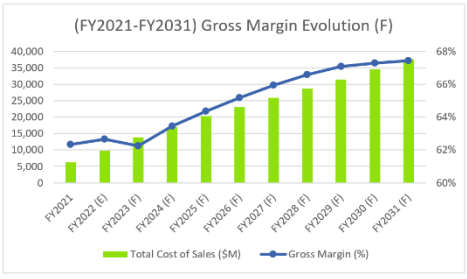
Source: Nvidia Investors Presentation

Exhibit 57: Nvidia and AMD's Gross Margins and ASP



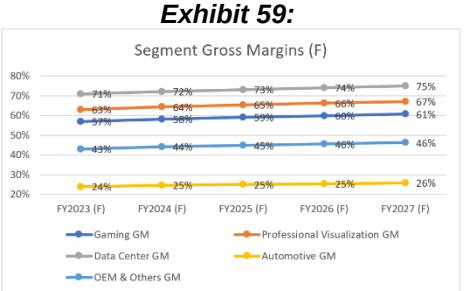
Source: IDC, Bloomberg

Exhibit 58:



Source: Analysts forecasts

Exhibit 59:



Source: Analysts forecasts

Summary

Overall, we believe the Data Center segment has the largest growth potential with an expected Year-on-Year (YoY) average revenue growth of (+26,5%) in the upcoming 5 years, followed by Gaming (+25,4%), Automotive (+25,2%), Professional Visualization (+16,9%), and finally OEM & Others (+1,8%) (Exhibit 54).

Total Revenues are expected to grow at a fast pace with $36,64 billion in FY2023 and nearly double to $75,94 billion by FY2027 (Exhibit 55). Nevertheless, growth is expected to slow down in the longer run, towards 10,38% by FY2030 and 6,74% by FY2035.

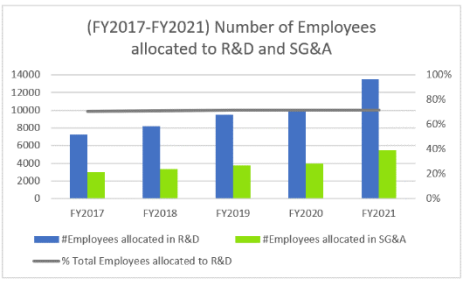
Cost of Revenues

Due to data constraints regarding Nvidia's input costs and quantities, cost of revenues (COGS) was forecasted implicitly using the Gross Margin as a value driver. With the Gross Margin (%) data for each segment in FY2021, and an intersegment CAGR of its evolution of 2.6% from FY2017 to FY2021 (Exhibit 56), we adjusted cost of sales across segments in the past to infer about the future, while also incorporating our own vision for gross margins.

Despite our general assumption of growing Gross Margins in the future, we expect the semiconductor shortage until FY2024 to be a strong barrier for increasing quantities sold (despite charging higher prices) and, consequently, limiting gross margins. One of the most relevant GPU inputs are chips provided by foundries like TSMC or Samsung. Chip unit foundry prices are likely to reach close to $260 by the end of FY2022, contributing to higher input costs. Nevertheless, Nvidia has been increasing ASP (average selling prices) throughout this shortage, which partially offsets the cost increase and prevented Gross Margins from falling, something which we also expect to happen into FY2023. As explained in the "Supply chain analysis and Semiconductor shortage" section, our vision is that the shortage should end by FY2024. Evidently, the nature of innovation makes it difficult to estimate how Gross Margin will progress in the future. Nevertheless, factors such as the new GPU architecture (Ada), which points out to make production processes more efficient, justifies our assumption for gross margins to improve slightly from FY2024 onwards (Exhibit 58).

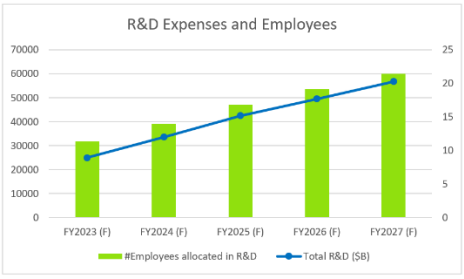
Lastly, as both company and industry mature, Gross Margins should reach its peak at 68% due to factors such as: **a)** The competitive advantages Nvidia holds seem to be sustainable, even in an industry marked by an environment of fast paced innovation; **b)** production of copper is expected to reach its peak by 2035, as some of the main copper reserves are expected to end by then, therefore it's expected electronic circuits will progressively become more expensive and the improvement of Gross Margins beyond 68% will become less attainable. As the industry decays through its maturity phase, we expect Nvidia's Gross Margins to stabilize towards 65%, a value that still assumes an edge above its competitors.

Exhibit 60:



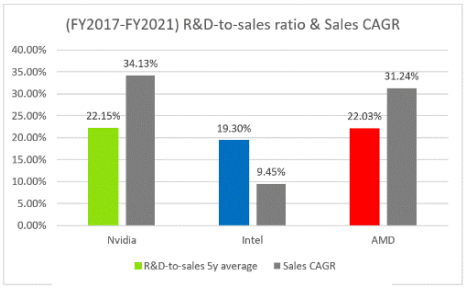
Source: Analysts forecasts

Exhibit 61:



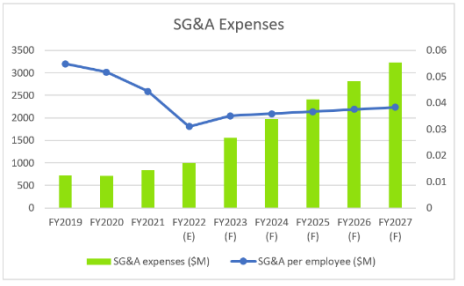
Source: Analysts estimates

Exhibit 62:



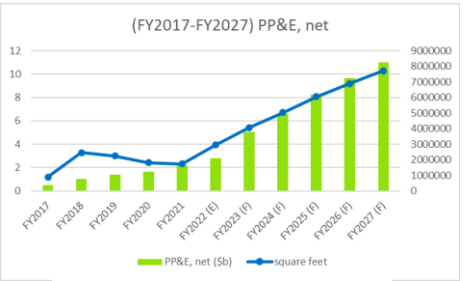
Source: Analysts forecasts

Exhibit 63:



Source: Analysts forecasts

Exhibit 64:



Source: Analysts forecasts

Operating Expenses – R&D and SG&A

As already expressed, R&D is fundamental for a company like Nvidia to be able to keep innovating ahead of its peers and maintain a competitive advantage. For the past 5 years, Nvidia has targeted ~71% of its total employees for R&D ends, which we expect to persist (Exhibit 60). Revenues per numbers of employees has been stable, and R&D expenses per employee had low fluctuations in the period of analysis. Therefore, we expect Nvidia to increase its work force in line with revenue growth (adjusted to inflation) into the future. For FY2023 we expect a total of 31.727 employees allocated to R&D, and R&D expenses of $8,90 billion (Exhibit 61). Competitors like AMD and Intel had a similar 5-year average R&D-to-sales ratio (+22,15%) to Nvidia, nevertheless Nvidia and AMD had more than thrice the Sales CAGR of Intel, which makes its R&D comparably less efficient at yielding sales figures (Exhibit 62).

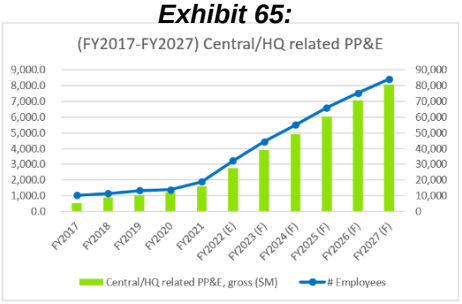
The remainder of employees are allocated to SG&A at a ratio of 29% of total employees. In terms of SG&A expenses per employee, FY2022 (E) had a considerable drop (with $0,03M) due to remote-work savings, as compared to past years (with an average of $0,05M). In FY2023 (F) we expect SG&A per employee to slightly mean revert (with a value of $0,035M), as we do not expect harsh pandemic lockdowns as seen during FY2022 to happen, and from then onwards evolve according to inflation (Exhibit 63). This expectation goes with the assumption the pandemic gave the opportunity for Nvidia to establish an efficient model of “Remote Work”, which CEO Jensen Huang intends to keep, giving employees the possibility to work from home for some days of the week.

Invested Capital

The firm’s PP&E has been increasing over the years (Exhibit 64), mainly driven by the construction of Nvidia’s new HQ in Santa Clara, California. The new complex consists of two buildings, Endeavour (500.000 square feet, built in FY2018) and Voyager (750.000 square feet, to be completed), totaling an owned property of 1,25 million square feet. In addition, Nvidia owns a R&D center in India and leases office facilities in multiple international locations, to be used as either R&D centers and/or administrative offices, together with a leased data center space in California. As the firm continues to grow its operations, we expect Nvidia to increase its central/HQ related PP&E, reflective of the increase in labor force (Exhibit 65), as well as an increase in operational equipment (such as testing equipment), which is directly driven by R&D projects (Exhibit 66).

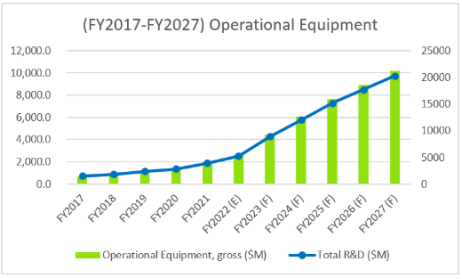
Another relevant driver of invested capital that we incorporated in our model was cash available for M&A, or more broadly called “firepower” (Exhibit 67). This item works as a forecast for Nvidia’s future inorganic growth activity, and we assumed to be an increasing portion of the firm’s previous year excess cash, as it is often the case for Nvidia to fund acquisitions using cash or cash equivalents. We expect that, as the firm matures, more inorganic growth will be needed to sustain the current levels of growth.

Exhibit 65:



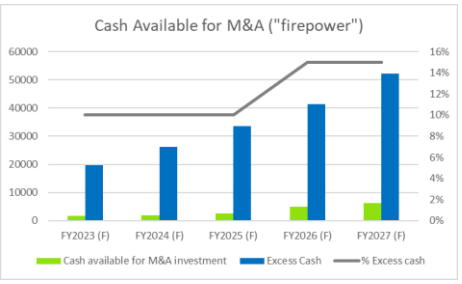
Source: Analysts forecasts

Exhibit 66:



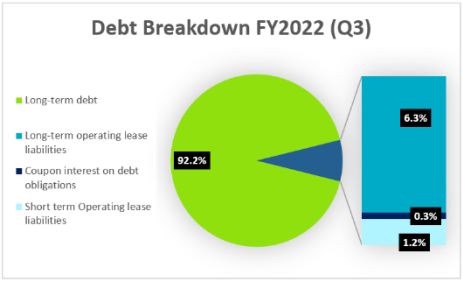
Source: Analysts forecasts

Exhibit 67:



Source: Analysts estimates

Exhibit 68:



Source: Company data

Net Financial Assets

Nvidia currently has outstanding roughly $12 billion in debt notes, with under $0,2 billion of it being short-term maturity (Exhibit 68). The firm also has a credit facility agreement, under which may borrow up to $575 million for general corporate purposes and can obtain revolving loan commitments up to $425 million. So far no amounts from these credit facilities were borrowed. Other significant debt-like items include operating lease obligations for the firm's HQ complex, domestic and international office facilities, and data center space.

Firms in this sector, with Nvidia being no exception, are usually characterized by having considerably high levels of excess cash in relation to debt (Exhibit 69), resulting often in negative values of net debt[14]. Tech companies often prefer financing themselves with equity (or cash reserves) rather than with debt, due to their often-overvalued stock, resulting in considerably low (and negative, if cash > debt) D/E ratios. Furthermore, these companies often do not need substantial investments in tangible assets, so they tend to use less debt. Nvidia's current D/E ratio, in market values, stands at -0,41%. Companies like AMD, Ambarella, Synaptics, Xilinx, Silicon Labs, Qualcomm and Lattice Semiconductors all have D/E ratios between -6,16% and 19,45%. (Exhibit 70). As for the remaining companies identified (Intel, Broadcom and Microchip Tech), neither surpasses the 20% D/E threshold, once again proving our argument regarding the typical capital structure in this sector: low debt levels, preference for equity (or cash) investment financing, very low D/E ratios (often negative).

Historically, Nvidia's debt has been slightly increasing[15] but not at all to the point where it grows in tandem with the business (Exhibit 71). In fact, Nvidia usually refinances its debt on the same maturities and principal amounts as the original agreement, only choosing to issue more debt when necessary to partially fund M&A transactions or other type of investments, such as its new HQ. Still, historically speaking, most acquisitions were made using cash or cash equivalents, such as marketable securities, and sometimes paid partially in stock.

Therefore, in conformity with all this evidence, together with the firm's current intention of not having a target D/E, we kept a constant current level of debt ($11.864 million) in our forecasted balance sheet, implicitly assuming Nvidia does not have a target capital structure for the future, which ultimately drove our reasoning for adopting the APV.

Relative Valuation

In addition to the APV model that we used to calculate Nvidia's intrinsic share price, a relative valuation was conducted to provide a different perspective on the firm's value.

[14] Net Debt = Debt (and Debt-like items) - Cash
[15] We don't see this as a worrying signal due to the large amount of cash in hand.

We opted to perform a comparables approach, starting with a framework to select peer companies that were similar enough to Nvidia to be used as a comparable, based on Market Cap, Unlevered Betas, Correlation with Nvidia's stock performance, and segment/market similarity.

The most similar companies overall were AMD, Intel and Xilinx (Exhibit 91), and while AMD and Intel were accepted as peers for the relative valuation, we rejected Xilinx on the basis of its small market cap, high likelihood of acquisition by AMD[16] and its product mix differing significantly from Nvidia, despite participating in 4/5 of Nvidia's segments.

Exhibit 91:

				Equivalent Segments?					
	Market Cap (M$)	Unlevered Beta	Correlation w/ NVIDIA	Gaming	Professional Visualization	Data Center	Automotive	OEM&Others	Comparable?
NVIDIA	754 950	1,32	1,00	Yes	Yes	Yes	Yes	Yes	-
AMD	167 314	2,07	0,43	Yes	Yes	Yes	Yes	Yes	Yes
Ambarella	7 619	1,29	0,15	No	No	No	No	Yes	No
Synaptics	11 061	1,18	0,32	No	No	No	Yes	Yes	No
Intel	205 244	0,58	0,32	Yes	Yes	Yes	Yes	Yes	Yes
Broadcom	260 010	0,80	0,41	No	No	Yes	No	Yes	No
Qualcomm	205 946	1,30	0,37	No	No	No	Yes	Yes	No
Xilinx	53 835	0,89	0,36	No	Yes	Yes	Yes	Yes	No
Lattice	10 573	1,09	0,29	No	No	No	No	Yes	No
Microchip	48 346	1,32	0,41	No	No	No	No	Yes	No
Silicon	8 093	1,10	0,43	No	No	No	No	Yes	No

Source: Analysts estimates

Having both AMD and Intel as our relative valuation peers, the multiples we chose were the following: Price to Sales (P/S), Price to Earnings (P/E), EV to EBIT[17] (EV/EBIT). These 3 multiples were calculated considering both FY22 estimated data and on a forward-looking data (FY23 forecast), to better match the time horizon in the APV.

Based on our relative valuation metrics, which can be graphically examined in the football field valuation charts (Appendix 10), it's fair to conclude that Nvidia's current share price is trading at a premium relative to its peers: it's current multiples are significantly above its comps, indicative of an extremely high growth assumption priced into the stock. It may not necessarily mean the stock is overvalued if the growth expectations of investors materialize going forward, as we have seen in recent years in the firm's financial results. Furthermore, if we compare the results from this approach with our APV model, the results gathered from both valuation methods do not seem to be in line: the APV is implying a higher share price target than the forward multiples valuation (Exhibit 92).

Exhibit 92:

FY23 Price Target	
P/S (Forward)	95,96
EV/EBIT (Forward)	129,8
P/E (Forward)	126,8
APV @ ku 7,78%	285,5

Source: Analysts estimates

Although helpful to triangulate and give more reassurance to our price target estimate, this valuation technique is highly limited and has its flaws: **1)** The use of only 2 peers, based on company similarly, gives us a very limited pool of comparables and limited results for mean/median of relative multiples; **2)** Intel's multiples are significantly below its peers (Exhibit 93), acting as an outlier and causing distortions for the relative valuation, possibly understating Nvidia's relative share price. As we have said before, Intel is at a different maturity stage than the likes of Nvidia and AMD, with more modest growth figures for Sales, Earnings and EBIT, which may justify smaller multiples.

Exhibit 93:

Multiples				
Company	P/S	EV/EBITDA	EV/EBIT	P/E
Nvidia	27,1x	78,0x	89,7x	86,5x
Intel	2,6x	4,1x	9,0x	10,0x
AMD	10,5x	41,0x	50,7x	55,8x

Source: Analysts estimates

Therefore, based on the limitations of the relative valuation, we are prioritizing and sticking to our APV model to infer about the target share price.

[16] Source: https://www.amd.com/en/press-releases/2020-10-27-amd-to-acquire-xilinx-creating-the-industry-s-high-performance-computing

[17] We opted for EBIT rather than EBITDA because of the low CAPEX and tangible asset needs for these companies (fabless manufacturing).

Appendix

Appendix 1: Nvidia's Historical Financial Statements

	January 29, 2017	January 28, 2018	January 27, 2019	January 26, 2020	January 31, 2021
Revenue	6 910,0	9 714,0	11 716,0	10 918,0	16 675,0
Cost of revenue	2 847,0	3 892,0	4 545,0	4 150,0	6 279,0
Gross profit	**4 063,0**	**5 822,0**	**7 171,0**	**6 768,0**	**10 396,0**
Operating expenses					
Research and development	1 463,0	1 797,0	2 376,0	2 829,0	3 924,0
Sales, general and administrative	663,0	815,0	991,0	1 093,0	1 940,0
D&A (not included in IS, auxiliary line)	*187,0*	*199,0*	*262,0*	*381,0*	*1 098,0*
Restructuring and other charges	3,0	0,0			
Total operating expenses	2 129,0	2 612,0	3 367,0	3 922,0	5 864,0
Income from operations	1 934,0	3 210,0	3 804,0	2 846,0	4 532,0
Interest income	54,0	69,0	136,0	178,0	57,0
Interest expense	-58,0	-61,0	-58,0	-52,0	-184,0
Other, net	-25,0	-22,0	14,0	-2,0	4,0
Other income (expense), net	-29,0	-14,0	92,0	124,0	-123,0
Income before income tax	1 905,0	3 196,0	3 896,0	2 970,0	4 409,0
Income tax expense (benefit)	239,0	149,0	-245,0	174,0	77,0
Net income	**1 666,0**	**3 047,0**	**4 141,0**	**2 796,0**	**4 332,0**
Net income per share:					
Basic	3,1	5,1	6,8	4,6	7,0
Diluted	2,6	4,8	6,6	4,5	6,9
Weighted average shares used in per share computation:					
Basic	541,0	599,0	608,0	609,0	617,0
Diluted	649,0	632,0	625,0	618,0	628,0
Consolidated Statements of Comprehensive Inc RESULTS					
Available-for-sale debt securities, Net change in unrealized gain (loss)	-16,0	-4,0	11,0	8,0	0,0
Cash flow hedges, Net change in unrealized gain (loss)	4,0	2,0	-5,0	5,0	18,0
Other comprehensive income (loss), net of tax	-12,0	-2,0	6,0	13,0	18,0
Total comprehensive income	**1 654,0**	**3 045,0**	**4 147,0**	**2 809,0**	**4 350,0**

	January 29, 2017	January 28, 2018	January 27, 2019	January 26, 2020	January 31, 2021
ASSETS					
Current assets:					
Cash and cash equivalents	1 766,0	4 002,0	782,0	10 896,0	847,0
Marketable securities	5 032,0	3 106,0	6 640,0	1,0	10 714,0
Accounts receivable, net	826,0	1 265,0	1 424,0	1 657,0	2 429,0
Inventories	794,0	796,0	1 575,0	979,0	1 826,0
Prepaid expenses and other current assets	118,0	86,0	136,0	157,0	239,0
Total current assets	8 536,0	9 255,0	10 557,0	13 690,0	16 055,0
Property and equipment, net	521,0	997,0	1 404,0	1 674,0	2 149,0
Operating lease assets				618,0	707,0
Goodwill	618,0	618,0	618,0	618,0	4 193,0
Intangible assets, net	104,0	52,0	45,0	49,0	2 737,0
Deferred income tax assets			560,0	548,0	806,0
Other assets	62,0	319,0	108,0	118,0	2 144,0
Total assets	**9 841,0**	**11 241,0**	**13 292,0**	**17 315,0**	**28 791,0**
LIABILITIES AND SHAREHOLDERS' EQUITY					
Current liabilities:					
Accounts payable	485,0	596,0	511,0	687,0	1 201,0
Accrued and other current liabilities	507,0	542,0	818,0	1 097,0	1 725,0
Short-term debt	796,0	15,0	0,0	0,0	999,0
Total current liabilities	1 788,0	1 153,0	1 329,0	1 784,0	3 925,0
Long-term debt	1 983,0	1 985,0	1 988,0	1 991,0	5 964,0
Long-term operating lease liabilities				561,0	634,0
Capital lease obligations, long-term	6,0				
Other long-term liabilities	277,0	632,0	633,0	775,0	1 375,0
Total liabilities	**4 048,0**	**3 770,0**	**3 950,0**	**5 111,0**	**11 898,0**
Commitments and contingencies - see Note 13			0,0		
Convertible debt conversion obligation	31,0				
Shareholders' equity:					
Preferred stock, $0.001 par value; 2 shares authorized; none issued				0,0	0,0
Common stock, $0.001 par value; 2,000 shares authorized; 965 shares issued and 620 outstanding as of January 31, 2021; 955 shares issued and 612 outstanding as of January 26, 2020	1,0	1,0	1,0	1,0	1,0
Additional paid-in capital	4 708,0	5 351,0	6 051,0	7 045,0	8 721,0
Treasury stock, at cost (345 shares in 2021 and 342 shares in 2020)	-5 039,0	-6 650,0	-9 263,0	-9 814,0	-10 756,0
Accumulated other comprehensive income	-16,0	-18,0	-12,0	1,0	19,0
Retained earnings	6 108,0	8 787,0	12 565,0	14 971,0	18 908,0
Total shareholders' equity	**5 762,0**	**7 471,0**	**9 342,0**	**12 204,0**	**16 893,0**
Total liabilities and shareholders' equity	**9 841,0**	**11 241,0**	**13 292,0**	**17 315,0**	**28 791,0**

	January 29, 2017	January 28, 2018	January 27, 2019	January 26, 2020	January 31, 2021
Cash flows from operating activities:					
Net income	1 666,0	3 047,0	4 141,0	2 796,0	4 332,0
Adjustments to reconcile net income to net cash provided by operating activities:					
Stock-based compensation expense	247,0	391,0	557,0	844,0	1 397,0
Depreciation and amortization	187,0	199,0	262,0	381,0	1 098,0
Deferred income taxes	197,0	-359,0	-315,0	18,0	-282,0
Loss on early debt conversions	21,0	19,0			
Other	33,0	20,0	-45,0	5,0	-20,0
Changes in operating assets and liabilities, net of acquisitions:					
Accounts receivable	-321,0	-440,0	-149,0	-233,0	-550,0
Inventories	-375,0	0,0	-776,0	597,0	-524,0
Prepaid expenses and other assets	-18,0	21,0	-55,0	77,0	-394,0
Accounts payable	184,0	90,0	-135,0	194,0	363,0
Accrued and other current liabilities	-135,0	33,0	256,0	54,0	239,0
Other long-term liabilities	-14,0	481,0	2,0	28,0	163,0
Net cash provided by operating activities	1 672,0	3 502,0	3 743,0	4 761,0	5 822,0
Cash flows from investing activities:					
Proceeds from maturities of marketable securities	969,0	1 078,0	7 232,0	4 744,0	8 792,0
Proceeds from sales of marketable securities	1 546,0	863,0	428,0	3 365,0	527,0
Purchases of marketable securities	-3 134,0	-36,0	-11 148,0	-1 461,0	-19 308,0
Acquisitions, net of cash acquired			0,0	-4,0	-8 524,0
Purchases related to property and equipment and intangible assets	-176,0	-593,0	-600,0	-489,0	-1 128,0
Investments and other, net	-5,0	-36,0	-9,0	-10,0	-34,0
Proceeds from sale of long-lived assets and investments	7,0	2,0	0,0		
Net cash provided by (used in) investing activities	-793,0	1 278,0	-4 097,0	6 145,0	-19 675,0
Cash flows from financing activities:					
Issuance of debt, net of issuance costs	1 988,0	0,0	0,0	0,0	4 968,0
Proceeds related to employee stock plans	167,0	139,0	137,0	149,0	194,0
Payments related to tax on restricted stock units	-673,0	-812,0	-1 032,0	-551,0	-942,0
Dividends paid	-261,0	-341,0	-371,0	-390,0	-395,0
Principal payments on property and equipment			0,0	0,0	-17,0
Payments related to repurchases of common stock	-739,0	-909,0	-1 579,0	0,0	0,0
Repayment of Convertible Notes	-176,0	-612,0	-16,0	0,0	0,0
Other	-15,0	-9,0	-5,0	0,0	-4,0
Net cash provided by (used in) financing activities	291,0	-2 544,0	-2 866,0	-792,0	3 804,0
Change in cash and cash equivalents	**1 170,0**	**2 236,0**	**-3 220,0**	**10 114,0**	**-10 049,0**
Cash and cash equivalents at beginning of period	596,0	1 766,0	4 002,0	782,0	10 896,0
Cash and cash equivalents at end of period	**1 766,0**	**4 002,0**	**782,0**	**10 896,0**	**847,0**
Supplemental disclosures of cash flow information:					
Cash paid for income taxes, net			61,0	176,0	249,0
Cash paid for interest			55,0	54,0	138,0

	January 29, 2017	January 28, 2018	January 27, 2019	January 26, 2020	January 31, 2021
Net income	1 666,0	3 047,0	4 141,0	2 796,0	4 332,0
Other comprehensive income (loss), net of tax					
Available-for-sale debt securities:					
Net unrealized gain (loss)	-17,0	-5,0	10,0	8,0	2,0
Reclassification adjustments for net realized gain included in net income	1,0	1,0	1,0	0,0	-2,0
Net change in unrealized gain (loss)	-16,0	-4,0	11,0	8,0	0,0
Cash flow hedges:					
Net unrealized gain (loss)	2,0	-1,0	6,0	10,0	9,0
Reclassification adjustments for net realized gain (loss) included in net income	2,0	3,0	-11,0	-5,0	9,0
Net change in unrealized gain (loss)	4,0	2,0	-5,0	5,0	18,0
Other comprehensive income (loss), net of tax	-12,0	-2,0	6,0	13,0	18,0
Total comprehensive income	**1 654,0**	**3 045,0**	**4 147,0**	**2 809,0**	**4 350,0**

Appendix 2: Nvidia's Forecasted Financial Statements

Income Statement forecast

	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022 (E)	FY2023 (F)	FY2024 (F)	FY2025 (F)	FY2026 (F)	FY2027 (F)
Core operations:											
Gaming Revenues	4 060,0	5 513,0	6 246,0	5 518,0	7 759,0	11 790,9	15 749,3	20 818,1	26 334,9	31 387,2	36 252,2
Professional Visualization Revenues	835,0	934,0	1 130,0	1 212,0	1 053,0	1 817,7	1 858,4	2 378,6	2 892,5	3 414,2	3 909,3
Data Center Revenues	830,0	1 932,0	2 932,0	2 983,0	6 696,0	10 431,3	16 693,4	20 599,8	24 855,5	28 527,3	32 406,0
Total Automotive Revenues (1+2)	487,0	558,0	641,0	700,0	536,0	661,4	1 029,1	1 179,4	1 425,6	1 637,5	1 964,1
OEM & Others Revenues	698,0	777,0	767,0	505,0	631,0	1 293,0	1 313,3	1 335,6	1 360,2	1 387,1	1 412,0
Total Revenues	**6 910,0**	**9 714,0**	**11 716,0**	**10 918,0**	**16 675,0**	**25 994,3**	**36 643,4**	**46 311,5**	**56 868,7**	**66 353,1**	**75 943,7**
Total Cost of Revenues	**2 847,0**	**3 892,0**	**4 545,0**	**4 150,0**	**6 279,0**	**9 707,1**	**13 831,5**	**16 926,6**	**20 269,2**	**23 097,4**	**25 865,8**
Total Gross Profit	**4 063,0**	**5 822,0**	**7 171,0**	**6 768,0**	**10 396,0**	**16 287,3**	**22 811,8**	**29 384,9**	**36 599,5**	**43 255,7**	**50 077,9**
Operating expenses:											
Total R&D	1 463,0	1 797,0	2 376,0	2 829,0	3 924,0	5 246,6	8 897,6	11 981,7	15 174,0	17 704,6	20 263,7
Sales, general and administrative (excluding D&A)	476,0	616,0	729,0	712,0	842,0	999,9	1 557,1	1 967,9	2 416,5	2 819,5	3 227,1
D&A	187,0	199,0	262,0	381,0	1 098,0	1 188,5	1 754,0	2 161,0	2 593,0	2 957,5	3 326,1
Core Result before Taxes	**1 937,0**	**3 210,0**	**3 804,0**	**2 846,0**	**4 532,0**	**8 852,4**	**10 603,2**	**13 274,3**	**16 415,9**	**19 774,0**	**23 261,0**
Statutory Taxes	678,2	1 088,7	798,7	597,9	951,8	1 859,2	2 226,9	2 787,9	3 447,8	4 153,0	4 885,4
Tax adjustments (benefit):	-381,0	-716,0	-530,0	-399,0	-724,0	-919,6	-1 060,2	-1 543,9	-1 923,5	-2 294,0	-2 676,1
Foreign tax rate differential	-315,0	-545,0	-412,0	-301,0	-561,0	-709,7	-850,4	-1 064,6	-1 316,5	-1 585,9	-1 865,5
US federal R&D tax credit	-70,0	-181,0	-141,0	-110,0	-173,0	-209,9	-209,9	-479,3	-607,0	-708,2	-810,5
Cash flow hedges, net change in unrealized gain (loss)	4,0	2,0	-5,0	5,0	18,0	0,0	0,0	0,0	0,0	0,0	0,0
Core Result	**1 643,8**	**2 839,3**	**3 530,3**	**2 652,1**	**4 322,2**	**7 912,7**	**9 436,5**	**12 030,2**	**14 891,7**	**17 915,0**	**21 051,6**
Non Core Operations:											
Restructuring and other Charges	3,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Interest income	54,0	69,0	136,0	178,0	57,0	318,1	448,5	566,8	696,0	812,1	929,4
Other, net	-25,0	-22,0	14,0	-2,0	4,0	0,0	0,0	0,0	0,0	0,0	0,0
Non-core result before taxes	**26,0**	**47,0**	**150,0**	**176,0**	**61,0**	**318,1**	**448,5**	**566,8**	**696,0**	**812,1**	**929,4**
Statutory taxes	9,1	15,9	31,5	37,0	12,8	66,8	94,2	119,0	146,2	170,6	195,2
Tax Adjustments (benefit)	-47,0	-219,0	-533,0	-51,0	-125,0	-195,0	-195,0	-195,0	-195,0	-195,0	-195,0
Available-for-sale debt securities, net change in unrealized gain (loss)	-16,0	-4,0	11,0	8,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Non-core result	**47,9**	**246,1**	**662,5**	**198,0**	**173,2**	**446,3**	**549,3**	**642,7**	**744,8**	**836,5**	**929,2**
Financial Operations:											
Interest expense	-58,0	-61,0	-58,0	-52,0	-184,0	-283,1	-431,1	-431,1	-431,1	-431,1	-431,1
Financial Result before taxes	**-58,0**	**-61,0**	**-58,0**	**-52,0**	**-184,0**	**-283,1**	**-431,1**	**-431,1**	**-431,1**	**-431,1**	**-431,1**
Statutory taxes	-20,3	-20,7	-12,2	-10,9	-38,6	-59,5	-90,5	-90,5	-90,5	-90,5	-90,5
Tax Adjustments	0	0	0	0	0	0	0	0	0	0	0
Financial Result	**-37,7**	**-40,3**	**-45,8**	**-41,1**	**-145,4**	**-223,7**	**-340,5**	**-340,5**	**-340,5**	**-340,5**	**-340,5**
Total Comprehensive Income	**1 654,0**	**3 045,0**	**4 147,0**	**2 809,0**	**4 350,0**	**8 135,4**	**9 645,2**	**12 332,4**	**15 295,9**	**18 410,9**	**21 640,3**

Balance Sheet Forecast

*Forecasted values in blue	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022 (E)	FY2023 (F)	FY2024 (F)	FY2025 (F)	FY2026 (F)	FY2027 (F)
Core Business											
Operating Cash*	345,5	485,7	585,8	545,9	833,8	1 299,7	1 832,2	2 315,6	2 843,4	3 317,7	3 797,2
Accounts receivable, net	826,0	1 265,0	1 424,0	1 657,0	2 429,0	4 215,9	5 943,0	7 511,1	9 223,3	10 761,6	12 317,0
Inventories:	794,0	796,0	1 575,0	979,0	1 826,0	2 435,0	3 705,7	4 534,9	5 430,5	6 188,2	6 929,9
Property and equipment, net:	521,0	997,0	1 404,0	1 674,0	2 149,0	2 786,9	5 051,4	6 607,5	8 253,5	9 630,0	11 021,9
Central/HQ related PP&E, gross	513,0	902,0	1 024,0	1 245,0	1 588,0	2 764,1	3 896,4	4 924,4	6 047,0	7 055,5	8 075,3
Operational equipment, gross	678,0	835,0	1 147,0	1 440,0	1 969,0	2 632,6	4 464,7	6 012,2	7 614,1	8 883,9	10 168,0
Accumulated depreciation and amortization	-670,0	-740,0	-767,0	-1 011,0	-1 408,0	-2 136,2	-3 309,6	-4 329,2	-5 407,6	-6 309,5	-7 221,4
Operating lease assets	0,0	0,0	0,0	618,0	707,0	978,6	1 682,8	2 126,8	2 611,6	3 047,1	3 487,6
Intangible assets, net	78,0	37,0	38,0	46,0	231,0	306,3	268,0	338,7	415,9	485,3	555,4
Patents and licensed technology, gross	468,0	469,0	491,0	520,0	706,0	854,7	1 465,7	1 852,5	2 274,7	2 654,1	3 037,7
Accumulated amortization	-390,0	-432,0	-453,0	-474,0	-475,0	-548,4	-1 197,7	-1 513,8	-1 858,8	-2 168,9	-2 482,3
Accounts payable	-485,0	-596,0	-511,0	-687,0	-1 201,0	-2 349,0	-3 347,1	-4 173,7	-4 442,6	-4 429,6	-4 251,9
Accrued and other current liabilities:	-482,0	-517,0	-798,0	-986,0	-1 530,0	-2 050,5	-2 760,7	-3 489,1	-4 284,4	-4 999,0	-5 721,5
Other long-term liabilities:	-136,0	-614,0	-614,0	-746,0	-1 134,0	-1 604,5	-2 035,9	-2 573,0	-3 159,6	-3 686,5	-4 219,4
Cash available for M&A investment							1 799,8	1 959,4	2 619,4	5 019,9	6 190,0
Core Business Invested Capital	1 461,5	1 853,7	3 103,8	3 100,9	4 310,8	6 018,3	12 139,3	15 158,2	19 511,1	25 334,6	30 106,2
Non Core Business:											
Goodwill	618,0	618,0	618,0	618,0	4 193,0	4 302,0	4 302,0	4 302,0	4 302,0	4 302,0	4 302,0
Prepaid expenses and other current assets	118,0	86,0	136,0	157,0	239,0	1 557,0	1 557,0	1 557,0	1 557,0	1 557,0	1 557,0
Other assets	62,0	319,0	108,0	118,0	2 144,0	3 761,0	3 761,0	3 761,0	3 761,0	3 761,0	3 761,0
Deferred tax assets, net	-141,0	-18,0	541,0	519,0	565,0	718,0	718,0	718,0	718,0	718,0	718,0
Other adjustments	-25,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Acquisiton related intangibles, net:	26,0	15,0	7,0	3,0	2 506,0	2 230,0	2 230,0	2 230,0	2 230,0	2 230,0	2 230,0
Acquisiton related intangibles, gross	193,0	195,0	195,0	195,0	3 280,0	3 396,0	3 396,0	3 396,0	3 396,0	3 396,0	3 396,0
Accumulated amortization	-167,0	-180,0	-188,0	-192,0	-774,0	-1 166,0	-1 166,0	-1 166,0	-1 166,0	-1 166,0	-1 166,0
Non Core Business Invested Capital	658,0	1 020,0	1 410,0	1 415,0	9 647,0	12 568,0	12 568,0	12 568,0	12 568,0	12 568,0	12 568,0
Total Invested Capital	2 119,5	2 873,7	4 513,8	4 515,9	13 957,8	18 586,3	24 707,3	27 726,2	32 079,1	37 902,6	42 674,2
Financial:											
Excess cash	6 452,5	6 622,3	6 836,2	10 351,1	10 727,3	17 998,3	19 593,9	26 194,3	33 466,3	41 266,9	52 076,3
Debt:	-2 810,0	-2 025,0	-2 008,0	-2 663,0	-7 792,0	-11 864,0	-11 864,0	-11 864,0	-11 864,0	-11 864,0	-11 864,0
Net Financial Assets	3 642,5	4 597,3	4 828,2	7 688,1	2 935,3	6 134,3	7 729,9	14 330,3	21 602,3	29 402,9	40 212,3
Total Shareholder's Equity	5 762,0	7 471,0	9 342,0	12 204,0	16 893,0	24 721,0	32 437,2	42 056,5	53 681,4	67 305,5	82 886,5
D/E Ratio (BV)	*-63%*	*-62%*	*-52%*	*-63%*	*-17%*	*-25%*	*-24%*	*-34%*	*-40%*	*-44%*	*-49%*
Transactions with shareholders		*-1 336,0*	*-2 276,0*	*53,0*	*339,0*	*-307,4*	*-1 929,0*	*-2 713,1*	*-3 671,0*	*-4 786,8*	*-6 059,3*
Payout Ratio		*44%*	*55%*	*-2%*	*-8%*	*4%*	*20%*	*22%*	*24%*	*26%*	*28%*

Appendix 3: Nvidia's Beta Regression Output

Regression

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,4817705
R Square	0,2321028
Adjusted R Square	0,2215836
Standard Error	0,1027266
Observations	75

Estimate beta:

5y of monthly data (most used by practitioners)

Rf: 10y zero coupon Gov bond

Market proxy: S&P500 in USD

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,232844373	0,232844	22,06481	1,20802E-05
Residual	73	0,770350729	0,010553		
Total	74	1,003195102			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,0369404	0,012166917	3,036139	0,003321	0,012691819	0,0611891	0,01269182	0,06118908
X Variable 1	**1,3128262**	0,279484149	4,697319	1,21E-05	**0,7558151**	**1,8698373**	0,7558151	1,86983731
	Raw Beta				95% CI			

Appendix 4: Unlevered Beta Multiples

Beta Multiples approach:

Company	Raw Beta	D/E	Unlevered Beta
AMD	2,064	-0,62%	2,074
Ambarella Inc	1,236	-5,85%	1,296
Synaptics Inc	1,192	1,28%	1,180
Intel Corp	0,650	15,94%	0,577
Broadcom Inc	0,886	13,91%	0,798
Qualcomm Inc	1,331	3,05%	1,299
Xilinx Inc	0,875	-2,72%	0,894
Lattice Semiconductor	1,093	0,81%	1,087
Microchip Technology	1,519	19,87%	1,313
Silicon Laboratories	1,094	-0,29%	1,097
Average	**1,194**		**1,162**
Median	**1,143**		**1,138**
Nvidia	1,3128	-0,42%	1,317

Appendix 5: Nvidia's Debt Notes

The carrying value of the Notes and the associated interest rates were as follows:

	Expected Remaining Term (years)	Effective Interest Rate	January 31, 2021	January 26, 2020
			(In millions)	
2.20% Notes Due 2021	0.6	2.38%	$ 1,000	$ 1,000
3.20% Notes Due 2026	5.6	3.31%	1,000	1,000
2.85% Notes Due 2030	9.2	2.93%	1,500	—
3.50% Notes Due 2040	19.2	3.54%	1,000	—
3.50% Notes Due 2050	29.2	3.54%	2,000	—
3.70% Notes Due 2060	39.2	3.73%	500	—
Unamortized debt discount and issuance costs			(37)	(9)
Net carrying amount			6,963	1,991
Less short-term portion			(999)	—
Total long-term portion			$ 5,964	$ 1,991

Source: Nvidia's Annual Report FY21

Appendix 6: Nvidia's S&P credit rating

S&P Global Ratings affirms NVIDIA at "A-" (Local Currency LT credit rating); outlook stable

August 25, 2021 Cbonds

S&P Global Ratings affirmed the "A-" Local Currency LT credit rating of NVIDIA on August 24, 2021. The outlook is stable.

Company — NVIDIA

Full name	NVIDIA Corporation
Registration country	USA
Industry	Semiconductors

Source: https://cbonds.com/news/1440969/

Appendix 7: Average Cumulative Default Rates for Information Technology sector

Global Corporate Average Cumulative Default Rates (1981-2020) (%)

	--Time horizon (years)--														
Rating	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
AAA	0.00	0.03	0.13	0.24	0.34	0.45	0.51	0.59	0.64	0.70	0.72	0.75	0.78	0.84	0.90
AA	0.02	0.06	0.11	0.21	0.30	0.41	0.49	0.56	0.63	0.70	0.76	0.82	0.88	0.93	0.99
A	0.05	0.13	0.22	0.33	0.46	0.60	0.76	0.90	1.05	1.20	1.34	1.46	1.59	1.71	1.84
BBB	0.16	0.43	0.75	1.14	1.54	1.94	2.27	2.61	2.93	3.24	3.55	3.80	4.03	4.28	4.54
BB	0.63	1.93	3.46	4.99	6.43	7.75	8.89	9.90	10.82	11.64	12.33	12.99	13.59	14.09	14.65
B	3.34	7.80	11.75	14.89	17.35	19.36	20.99	22.31	23.50	24.62	25.58	26.31	26.99	27.63	28.24
CCC/C	28.30	38.33	43.42	46.36	48.58	49.61	50.75	51.49	52.16	52.76	53.21	53.68	54.23	54.69	54.76
Investment grade	0.09	0.24	0.41	0.63	0.86	1.09	1.30	1.50	1.69	1.88	2.05	2.20	2.35	2.49	2.65
Speculative grade	3.71	7.19	10.18	12.63	14.64	16.30	17.68	18.83	19.86	20.81	21.61	22.29	22.93	23.49	24.04
All rated	1.53	3.00	4.27	5.35	6.25	7.01	7.64	8.18	8.67	9.12	9.50	9.83	10.13	10.41	10.69

Sources: S&P Global Ratings Research and S&P Global Market Intelligence's CreditPro®.

Source: https://www.maalot.co.il/Publications/TS20210408160139.PDF

Appendix 8: Nvidia's Valuation Decomposition

Steady state value drivers:	
ROIC	30%
g	4,54%
Cost of Equity (unlevered)	7,80%

Sum of Discounted FCF	309 094,7
Terminal Value	2 657 514,0
Discounted TV	376 804,5
Core Unlevered Business Value	**685 899,2**

(1) Total Value Unlevered Firm	685 899,2
(2) PV Tax shields	2 491,7
APV (1+2)	688 390,9
Plus: Non-Core Value	12 568,0
Enterprise Value	**700 958,9**
Check	TRUE
Less: Net Debt & Other claims	-7 729,9
Equity Value	708 688,8
# Shares Outstanding (million)	2 500
Intrinsic Share Price	**283,48**

Appendix 9: Relative Valuation multiples

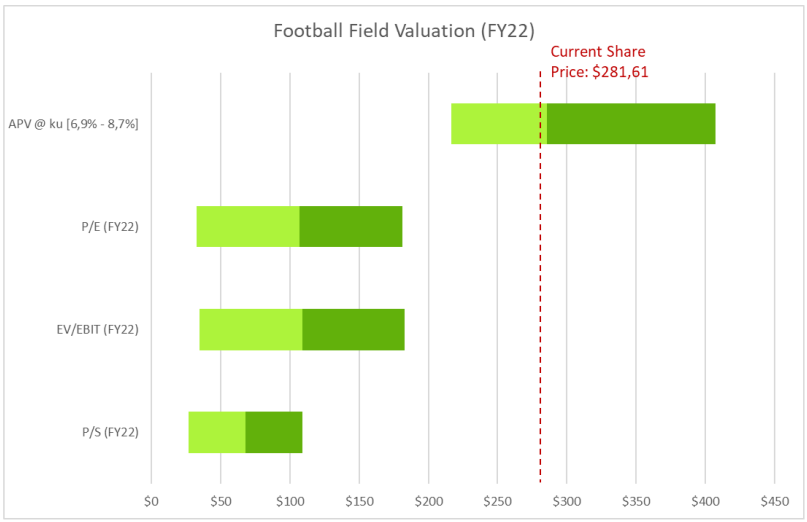
Market Data					
Company	Equity (MV)	Net Debt & Other Claims	Implicit Enterprise Value	Share price	Shares outstanding (mil)
Nvidia	704 025,0	-6 134,3	710 159,3	281,6	2 500
Intel	203 350,0	29 166,3	174 183,7	50,0	4067
AMD	162 295,4	-2 750,2	165 045,6	133,8	1213

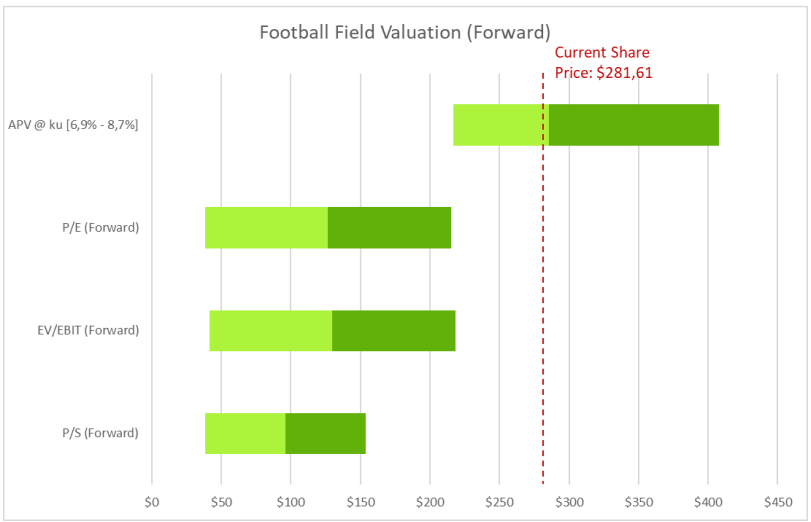
Financial Data				Multiples			
Sales	EBITDA	EBIT	EPS	P/S	EV/EBITDA	EV/EBIT	P/E
25 994,3	9 101,2	7 912,7	3,25	27,1x	78,0x	89,7x	86,5x
77 994,7	42 461,3	19 289,3	5,01	2,6x	4,1x	9,0x	10,0x
15 477,3	4 022,7	3 254,7	2,40	10,5x	41,0x	50,7x	55,8x

**These two tables are the continuation of each other horizontally*

	P/S	EV/EBITDA	EV/EBIT	P/E
Min	2,6x	4,1x	9,0x	10,0x
Mean	6,5x	22,6x	29,9x	32,9x
Median	6,5x	22,6x	29,9x	32,9x
Max	10,5x	41,0x	50,7x	55,8x

Appendix 10: Relative Valuation football field





Appendix 11: Nvidia with vs without Arm share price difference according to P/S

Nvidia + Arm		Min	Mean	Median	Max	Nvidia
Sales (Forward - FY2023)	**38 728,7**					
P/S		2,6x	6,5x	6,5x	10,5x	27,1x
# Shares outstanding (million)	**2 575,3**					
Implicit Share price		**39,21**	**98,45**	**98,45**	**157,69**	**407,30**

Nvidia standalone		Min	Mean	Median	Max	Nvidia
Sales (Forward - FY2023)	**36 643,4**					
P/S		2,6x	6,5x	6,5x	10,5x	27,1x
# Shares outstanding (million)	**2 500**					
Implicit Share price		**38,22**	**95,96**	**95,96**	**153,70**	**396,98**

Share price difference with vs without Arm	2,60%	2,60%	2,60%	2,60%	2,60%

Appendix 12: Nvidia, Intel, AMD and Xilinx Financial Ratios

Scenario Analysis		
Risk	**Scenario Share Price**	**Downside**
Industry related risks		
Innovation	255,30	-10,58%
Competition	255,88	-10,38%
Supply Chain related risks		
Manufacturing	243,92	-14,57%
Operations related risks		
System Security and Cyber-attacks	274,94	-3,70%
Business disruptions	252,23	-11,66%
Customer Concentration	281,78	-1,31%

Appendix 13: Nvidia, Intel, AMD and Xilinx Financial Ratios

Nvidia:

Activity Ratios	FY2017	FY2018	FY2019	FY2020	FY2021
Average Holding Period	101,8	74,7	126,5	86,1	106,1
Average Collection Period	43,6	47,5	44,4	55,4	53,2
Average Payable Period	62,2	55,9	41,0	60,4	69,8
Cash Conversion Cycle	**83,2**	**66,3**	**129,8**	**81,1**	**89,5**

Liquidity	FY2017	FY2018	FY2019	FY2020	FY2021
Current Ratio	4,8	8,0	7,9	7,7	4,1
Quick Ratio	4,3	7,3	6,8	7,1	3,6
Cash Ratio	1,0	3,5	0,6	6,1	0,2
NWC	6 748	8 102	9 228	11 906	12 130

Capital Structure	FY2017	FY2018	FY2019	FY2020	FY2021
Gearing Ratio	172%	160%	107%	170%	21%
D/E Ratio (BV)	-63%	-62%	-52%	-63%	-17%
Debt/EBITDA Ratio	-171%	-135%	-119%	-238%	-52%
Net PP&E/Total Assets	5%	9%	11%	10%	7%
Solvency Ratio	142%	198%	237%	239%	142%
Financial Autonomy Ratio	59%	66%	70%	70%	59%

Core Profitability Margins	FY2017	FY2018	FY2019	FY2020	FY2021
Gross Margin	59%	60%	61%	62%	62%
EBITDA Margin	31%	35%	35%	30%	34%
EBIT Margin	28%	33%	32%	26%	27%
Net Profit Margin	24%	29%	30%	24%	26%

Profitability from Investments	FY2017	FY2018	FY2019	FY2020	FY2021
Return on Assets (ROA)	17%	25%	27%	15%	15%
Core Asset Turnover	326%	338%	260%	242%	119%
Return on Invested Capital (ROIC)	80%	107%	93%	63%	32%
Return on Equity (ROE)	30%	42%	45%	24%	27%

Intel:

Activity Ratios	FY2016	FY2017	FY2018	FY2019	FY2020
Average Holding Period	131,9	164,1	146,9	168,0	138,6
Average Collection Period	28,8	32,6	34,6	38,8	31,8
Average Payable Period	58,8	68,8	77,4	79,3	91,8
Cash Conversion Cycle	**101,9**	**127,9**	**104,1**	**127,5**	**78,6**

Liquidity Ratios	FY2016	FY2017	FY2018	FY2019	FY2020
Current Ratio	1,7	1,7	1,7	1,4	1,9
Quick Ratio	1,5	1,3	1,3	1,0	1,6
Cash Ratio	0,3	0,2	0,2	0,2	0,2
NWC	15 206	12 079	12 161	8 929	22 495

Capital Structure	FY2016	FY2017	FY2018	FY2019	FY2020
Gearing Ratio	24%	27%	25%	26%	28%
D/E Ratio (BV)	31%	37%	33%	35%	40%
Debt/EBITDA Ratio	89%	96%	76%	83%	89%
Net PP&E/Total Assets	32%	33%	38%	41%	37%
Solvency Ratio	143%	129%	141%	132%	112%
Financial Autonomy Ratio	58%	56%	58%	57%	53%

Core Profitability Margins	FY2016	FY2017	FY2018	FY2019	FY2020
Gross Margin	74%	75%	75%	74%	71%
EBITDA Margin	39%	43%	46%	46%	46%
EBIT Margin	26%	30%	33%	31%	31%
Net Profit Margin	19%	15%	30%	27%	27%

Profitability from Investments	FY2016	FY2017	FY2018	FY2019	FY2020
Return on Assets (ROA)	10%	8%	16%	14%	14%
Core Asset Turnover	69%	66%	72%	69%	69%
Return on Invested Capital (ROIC)	12%	11%	21%	20%	19%
Return on Equity (ROE)	17%	16%	28%	27%	27%

AMD:

Activity Ratios	FY2016	FY2017	FY2018	FY2019	FY2020
Average Holding Period	86,1	76,3	79,9	98,4	100,0
Average Collection Period	26,3	31,5	69,6	100,8	77,2
Average Payable Period	50,5	42,2	50,0	99,0	33,5
Cash Conversion Cycle	**61,9**	**65,6**	**99,6**	**100,2**	**143,8**

Liquidity Ratios	FY2016	FY2017	FY2018	FY2019	FY2020
Current Ratio	1,9	1,7	1,8	1,9	2,5
Quick Ratio	1,3	1,3	1,4	1,5	2,0
Cash Ratio	0,9	0,8	0,5	0,6	0,7
NWC	1 184	1 121	1 556	2 238	3 726

Capital Structure	FY2016	FY2017	FY2018	FY2019	FY2020
Gearing Ratio	58%	53%	33%	-10%	-21%
D/E Ratio (BV)	139%	115%	50%	-9%	-17%
Debt/EBITDA Ratio	-155%	538%	141%	-40%	-74%
Net PP&E/Total Assets	5%	7%	8%	8%	7%
Solvency Ratio	14%	20%	38%	88%	187%
Financial Autonomy Ratio	13%	17%	28%	47%	65%

Core Profitability Margins	FY2016	FY2017	FY2018	FY2019	FY2020
Gross Margin	26%	37%	40%	46%	48%
EBITDA Margin	-8%	4%	10%	12%	17%
EBIT Margin	-11%	1%	7%	8%	14%
Net Profit Margin	-12%	1%	7%	7%	25%

Profitability from Investments	FY2016	FY2017	FY2018	FY2019	FY2020
Return on Assets (ROA)	-15%	2%	10%	8%	27%
Core Asset Turnover	434%	411%	341%	261%	203%
Return on Invested Capital (ROIC)	-40%	5%	22%	16%	50%
Return on Equity (ROE)	-70%	24%	41%	18%	40%

Xilinx:

Activity Ratios	FY2017	FY2018	FY2019	FY2020	FY2021
Average Holding Period	129,4	126,6	130,0	116,9	130,2
Average Collection Period	37,8	56,6	40,0	31,5	33,1
Average Payable Period	61,7	53,1	48,4	39,2	48,6
Cash Conversion Cycle	**105,5**	**130,0**	**121,6**	**109,2**	**114,7**

Liquidity Ratios	FY2017	FY2018	FY2019	FY2020	FY2021
Current Ratio	4,3	4,6	8,2	2,7	6,0
Quick Ratio	4,1	4,3	7,5	2,4	5,5
Cash Ratio	1,1	2,4	3,3	1,6	2,3
NWC	2 983	3 243	3 417	1 823	3 122

Capital Structure	FY2017	FY2018	FY2019	FY2020	FY2021
Gearing Ratio	-232%	-215%	-167%	-53%	-91%
D/E Ratio (BV)	-70%	-68%	-62%	-35%	-48%
Debt/EBITDA Ratio	-272%	-244%	-201%	-110%	-215%
Net PP&E/Total Assets	6%	6%	6%	8%	6%
Solvency Ratio	112%	87%	125%	97%	110%
Financial Autonomy Ratio	53%	47%	56%	49%	52%

Core Profitability Margins	FY2017	FY2018	FY2019	FY2020	FY2021
Gross Margin	73%	72%	71%	70%	72%
EBITDA Margin	33%	32%	34%	29%	28%
EBIT Margin	30%	29%	31%	26%	24%
Net Profit Margin	27%	29%	29%	24%	22%

Profitability from Investments	FY2017	FY2018	FY2019	FY2020	FY2021
Return on Assets (ROA)	13%	14%	17%	16%	12%
Core Asset Turnover	312%	329%	285%	209%	209%
Return on Invested Capital (ROIC)	103%	367%	336%	141%	175%
Return on Equity (ROE)	25%	19%	31%	34%	24%

Disclosures and Disclaimers

Report Recommendations

Buy	Expected total return (including expected capital gains and expected dividend yield) of more than 10% over a 12-month period.
Hold	Expected total return (including expected capital gains and expected dividend yield) between 0% and 10% over a 12-month period.
Sell	Expected negative total return (including expected capital gains and expected dividend yield) over a 12-month period.

This report was prepared by [*insert student's name*], a Master in Finance student of Nova School of Business and Economics ("Nova SBE"), within the context of the Field Lab – Equity Research.

This report is issued and published exclusively for academic purposes, namely for academic evaluation and master graduation purposes, within the context of said Field Lab – Equity Research. It is not to be construed as an offer or a solicitation of an offer to buy or sell any security or financial instrument.

This report was supervised by a Nova SBE faculty member, acting merely in an academic capacity, who revised the valuation methodology and the financial model.

Given the exclusive academic purpose of the reports produced by Nova SBE students, it is Nova SBE understanding that Nova SBE, the author, the present report and its publishing, are excluded from the persons and activities requiring previous registration from local regulatory authorities. As such, Nova SBE, its faculty and the author of this report have not sought or obtained registration with or certification as financial analyst by any local regulator, in any jurisdiction. In Portugal, neither the author of this report nor his/her academic supervisor is registered with or qualified under COMISSÃO DO MERCADO DE VALORES MOBILIÁRIOS ("CMVM", the Portuguese Securities Market Authority) as a financial analyst. No approval for publication or distribution of this report was required and/or obtained from any local authority, given the exclusive academic nature of the report.

The additional disclaimers also apply:

USA: Pursuant to Section 202 (a) (11) of the Investment Advisers Act of 1940, neither Nova SBE nor the author of this report are to be qualified as an investment adviser and, thus, registration with the Securities and Exchange Commission ("SEC", United States of America's securities market authority) is not necessary. Neither the author nor Nova SBE receive any compensation of any kind for the preparation of the reports.

Germany: Pursuant to §34c of the WpHG (*Wertpapierhandelsgesetz*, i.e., the German Securities Trading Act), this entity is not required to register with or otherwise notify the *Bundesanstalt für Finanzdienstleistungsaufsicht* ("BaFin", the German Federal Financial Supervisory Authority). It should be noted that Nova SBE is a fully-owned state university and there is no relation between the student's equity reports and any fund raising programme.

UK: Pursuant to section 22 of the Financial Services and Markets Act 2000 (the "FSMA"), for an activity to be a regulated activity, it must be carried on "by way of business". All regulated activities are subject to prior authorization by the Financial Conduct Authority ("FCA"). However, this report serves an exclusively academic purpose and, as such, was not prepared by way of business. The author - a Master's student - is the **sole and exclusive responsible** for the information, estimates and forecasts contained herein, and for the opinions expressed, which exclusively reflect his/her own judgment at the date of the report. Nova SBE and its faculty have no single and formal position in relation to the most appropriate valuation method, estimates or projections used in the report and may not be held liable by the author's choice of the latter.

The information contained in this report was compiled by students from public sources believed to be reliable, but Nova SBE, its faculty, or the students make no representation that it is accurate or complete, and accept no liability whatsoever for any direct or indirect loss resulting from the use of this report or of its content.

Students are free to choose the target companies of the reports. Therefore, Nova SBE may start covering and/or suspend the coverage of any listed company, at any time, without prior notice. The students or Nova SBE are not responsible for updating this report, and the opinions and recommendations expressed herein may change without further notice.

The target company or security of this report may be simultaneously covered by more than one student. Because each student is free to choose the valuation method, and make his/her own assumptions and estimates, the resulting projections, price target and recommendations may differ widely, even when referring to the same security. Moreover, changing market conditions and/or changing subjective opinions may lead to significantly different valuation results. Other students' opinions, estimates and recommendations, as well as the advisor and other faculty members' opinions may be inconsistent with the views expressed in this report. Any recipient of this report should understand that statements regarding future prospects and performance are, by nature, subjective, and may be fallible.

This report does not necessarily mention and/or analyze all possible risks arising from the investment in the target company and/or security, namely the possible exchange rate risk resulting from the security being denominated in a currency either than the investor's currency, among many other risks.

The purpose of publishing this report is merely academic and it is not intended for distribution among private investors. The information and opinions expressed in this report are not intended to be available to any person other than Portuguese natural or legal persons or persons domiciled in Portugal. While preparing this report, students did not have in consideration the specific investment objectives, financial situation or particular needs of any specific person. Investors should seek financial advice regarding the appropriateness of investing in any security, namely in the security covered by this report.

The author hereby certifies that the views expressed in this report accurately reflect his/her personal opinion about the target company and its securities. He/ She has not received or been promised any direct or indirect compensation for expressing the opinions or recommendation included in this report.

The content of each report has been shown or made public to restricted parties prior to its publication in Nova SBE's website or in Bloomberg Professional, for academic purposes such as its distribution among faculty members for students' academic evaluation.

Nova SBE is a state-owned university, mainly financed by state subsidies, students tuition fees and companies, through donations, or indirectly by hiring educational programs, among other possibilities. Thus, Nova SBE may have received compensation from the target company during the last 12 months, related to its fundraising programs, or indirectly through the sale of educational, consulting or research services. Nevertheless, no compensation eventually received by Nova SBE is in any way related to or dependent on the opinions expressed in this report. The Nova School of Business and Economics does not deal for or otherwise offer any investment or intermediation services to market counterparties, private or intermediate customers.