



BY: CHAN KAH YAN (1004639), JAMES HUANG (1005461), HUANG XINYI (1005488), LOW HAORON (1005018)

Sector/Industry: Information Technology  
Current Price: USD \$271

NVIDIA Corp. (NVDA)  
Target Price: USD \$334.05 (+23%)

Recommendation: BUY  
24 April 2023

## EXECUTIVE SUMMARY

Our group would like to issue a BUY call on Nvidia with a one-year target price of USD\$334.05. Nvidia is a leading technology company that has developed a platform strategy focused on bringing together hardware (GPUs), software (CUDA) and programming libraries, to enable developers to seamlessly create solutions to serve their market needs. Their main market segments include gaming, data centres, professional visualisation and automotive.

Nvidia provides customers with ready-made solutions that integrate hardware and software that deeply entrenches its customers in its ecosystem and increases switching cost at the same time. Nvidia also provides the lowest cost in the industry for running AI workloads such as High-Performance Computing, AI Inferencing and AI Training which makes it the preferred partner for Cloud Service Providers. Moreover, Nvidia offers greater customisability with its domain-specific applications that enable greater flexibility for developers to meet their specific AI needs, making it a preferred partner due to its ease of use. This competitive moat that they have built has allowed them to maintain strong growth and outperform their main competitors like AMD, cementing their status as a strong contender within the industry.

NVIDIA continues to invest heavily on their research and development to help with extending their reach into different markets. With more firms shifting towards the cloud to expand their operations, there has been an increase in demand in the data centre accelerator market which NVIDIA plans to capitalise on. Besides shifting their focus from the gaming industry to the data centre industry, there have been efforts to expand their capabilities through acquisitions like Mellanox. Additionally, NVIDIA has acknowledged the growing importance of Artificial Intelligence and machine learning technologies across various sectors, including automotive and healthcare. By collaborating with leading companies in said industries, NVIDIA has the ability to leverage on these expanding markets and further grow their revenue.

In conclusion, NVIDIA remains a powerhouse in the industry due to its extensive software infrastructure that gives it a competitive edge in terms of cost efficiency and makes them the preferred partner for other industry leaders. Coupled with its current ventures that have a high potential for growth, we reiterate a buy call at USD\$334.05.

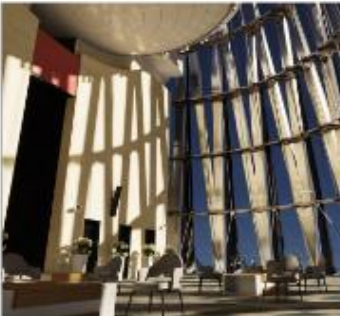
Figure 1



**Data Center**  
56% of FY23  
revenue



**Gaming**  
33% of FY23  
revenue



**Professional  
Visualization**  
6% of FY23  
revenue



**Automotive**  
3% of FY23  
revenue  
*Source: Nvidia*

## BUSINESS DESCRIPTION

### BUSINESS OVERVIEW

Nvidia is a leading technology company that has developed a platform strategy focused on bringing together hardware (GPUs), software (CUDA) and programming libraries, to enable developers to seamlessly create solutions to serve their market needs. While the computing requirements of these end markets are diverse, Nvidia addresses them with a unified underlying architecture leveraging their GPUs and software stacks.

Nvidia's market segments include gaming, data centres, professional visualisation and automotive. With the Data centre and gaming segment being the major component of Nvidia's revenue (Figure 1).

By leveraging its platform strategy and unified underlying architecture, Nvidia has well positioned itself as the leader in the Artificial Intelligence (AI) and Data Centre field, which enables them to continue driving innovation and growth across its four market segments.

### CORPORATE STRATEGY

Nvidia's corporate strategy is focused on continued expansion in the field of accelerated computing. They aim to create software, systems, and chips to serve new markets, with the goal of leveraging their technology to solve some of the world's most complex computing challenges.

A key part of this strategy is the development of new chips that open up new markets. For example, Nvidia's new Orin robotics processor chip is the central computer for a new generation of logistics robots, delivery robots, and self-driving cars, trucks, and taxis. This chip has the potential to transform industries and enable new use cases for autonomous systems.

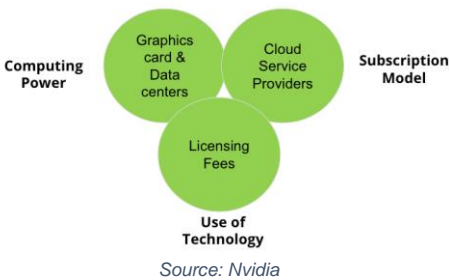
Nvidia's corporate strategy also includes a focus on partnerships and collaboration. They have worked closely with a variety of companies and organisations to develop new solutions and applications for their technology. For example, Nvidia has partnered with leading cloud providers such as Amazon Web Services, Microsoft Azure, and Google Cloud to bring their technology to the cloud and enable faster and more efficient data processing.

Nvidia's corporate strategy is a framework that is long-term in nature, designed with the objective to gain a competitive advantage over other market participants while delivering both on customers' and stakeholders' promises.

### BUSINESS MODEL

NVIDIA's business model is centred around designing and selling high-performance computer hardware for a variety of applications, with a focus on graphics processing and AI technology (Figure 2). NVIDIA generates revenue by selling its graphics processing units (GPUs) to original equipment manufacturers (OEMs), system builders, and add-in card manufacturers. These GPUs are used in a wide range of devices, including desktop and laptop computers, gaming consoles, and data centre servers.

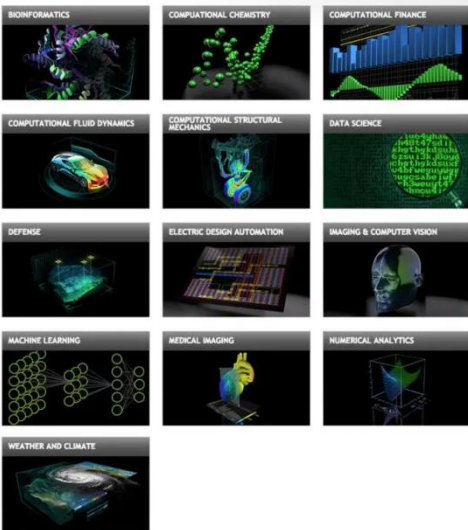
Figure 2



Source: Nvidia

Figure 3

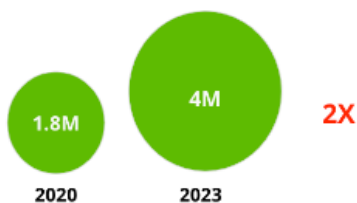
CUDA application domains



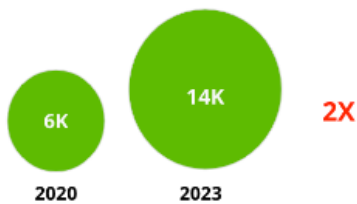
Source: Nvidia

Figure 4

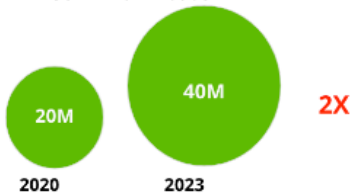
No. of Developers



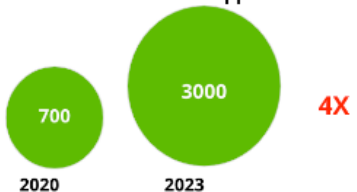
No. of AI Startups



CUDA Downloads



GPU-Accelerated Applications



Source: Nvidia

Another important aspect of Nvidia's business model is its use of a subscription model. This allows customers to access Nvidia's technology on a recurring basis, providing a predictable revenue stream for Nvidia while also offering customers greater flexibility and affordability.

Lastly, Nvidia also generates revenue through the licensing of its technology to other companies. This includes licensing fees for the use of their intellectual property and technology.

## INDUSTRY OVERVIEW AND COMPETITIVE POSITIONING

### NVIDIA'S MOATS

#### a. GREATER CUSTOMISABILITY WITH ITS DOMAIN-SPECIFIC APPLICATIONS

Nvidia's Compute Unified Device Architecture (CUDA) is a proprietary parallel computing platform and computing model used exclusively with Nvidia's GPUs for different applications (Figure 3). CUDA provides the libraries, debuggers and APIs which make it a lot easier to make GPUs programmable for general-purpose computing tasks. With CUDA, developers can easily write software programs using familiar programming languages and subsequently execute them on Nvidia GPUs.

With a suite of more than 300 libraries and 400 AI models that enables developers to create their own model that best suits their AI needs. Through Nvidia's application-specific frameworks, developer productivity has accelerated and the common challenges of deploying AI within specific industries (Figure 5) have been addressed.



Figure 5, Source: Nvidia

As such, there is an increase of over 4 times in their CUDA downloads and over 3 times in the number of developers (Figure 4), which widened Nvidia's developer ecosystem.

In contrast, AMD which is Nvidia's largest competitor in the data centre market has a software ecosystem problem due to AMD's software side being understaffed and underfinanced which has led CUDA to be 30% faster than AMD's OpenCL.

Moreover, according to industry experts, "While Intel and Nvidia have a long history of software development in support of their chips, the same can't be said of AMD. "We like the looks of the MI300 and the roadmap, but the software ecosystem is still a problem," said Tease (Lenovo's vice president of HPC and AI). "It's still not turnkey and easy for run-rate customers."

Also, "[Developing software] takes much longer than most people would realise. And I think they [AMD] had several experiences, which were understaffed, underfinanced. And I think they've been doing something more serious for about at least three years now. And they're coming with something that's a little bit promising that I see from time to time. So, they are not there yet, but they're getting much closer to having the stack, which



makes sense.” Former Head of AI Developer Relations at Nvidia (Tegus expert transcript).

In essence, we can tell that Nvidia is ahead in their software ecosystem compared to AMD due to Nvidia’s first mover advantage, and AMD’s software side being understaffed and underfinanced, AMD is not going to catch up to Nvidia anytime soon.

This is not only for AMD’s software side but also OpenCL Support (Figure 6), an open source and works across CPUs, GPUs, and FPGAs among other hardware accelerators. However, it never seemed to get widespread adoption as its performance lags that of CUDA.

## b. GREATEST COST-EFFICIENCY FOR AI WORKLOADS

In comparison with a normal AI data centre, Nvidia’s A100 GPU data centre has one-tenth of the cost, consumes one-twentieth of the power and one A100 GPU rack produces as much AI workloads as 25 racks from a normal AI data centre, V100 GPU data centre. This allows Nvidia’s data centre clients to cut cost while producing the same level of AI workloads.

In addition, we further expect Nvidia to remain the leader in the data centre market with their newer H100 GPU. It offers faster AI speeds of over 3 times for High-Performance Computing, over 20 times for AI Inferencing, and over 3 times for AI training compared to the A100 (Figure 10). As such, we expect that the data centre clients would be able to get even greater AI workload performance for the same cost.

Thus, with the lowered cost for AI workloads and a growing developer ecosystem, Nvidia is able to provide the full stack of AI support that would incur a high switching cost. This enables Nvidia to capture all major cloud service providers (Figure 7) and has the largest accelerator share in the market (Figure 9) and among most of its cloud providers (Figure 8).

Figure 6

Open Source Deep Learning Software: Support for CUDA		OpenCL Support	
	CUDA Support		OpenCL Support
Apache Singa	YES	Yes	
Deeplearning4j	YES	In development	
Dlib	YES	No	
Keras	YES	In development	
Microsoft CNTK	YES	No	
MXNet	YES	In development	
openNN	YES	No	
Google TensorFlow	YES	In development	
Theano	YES	In development	
Torch	YES	In development	

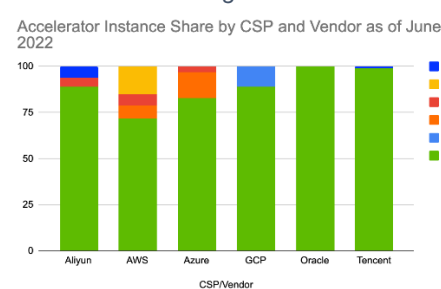
Source: A Performance Comparison of CUDA and OpenCL

Figure 7



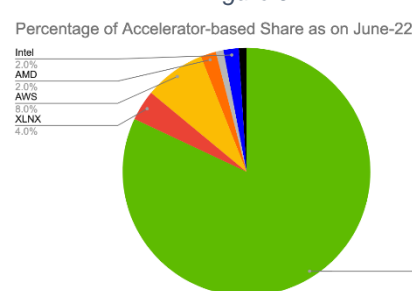
Source: Nvidia

Figure 8



Source: Lifter Insights, Jefferies

Figure 9



Source: Lifter Insights, Jefferies

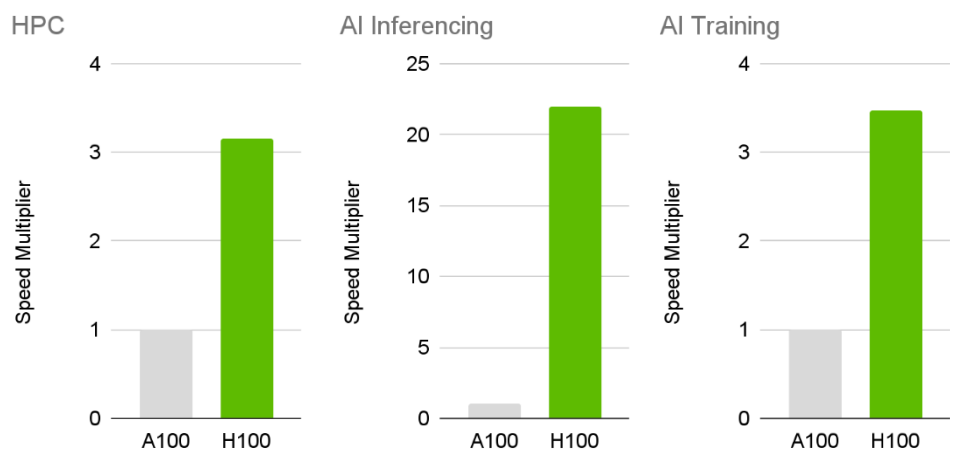


Figure 10, Source: Nvidia

## COMPETITIVE ANALYSIS ACROSS DIFFERENT LEVELS

### a. NVIDIA VS ESTABLISHED CHIP COMPANIES (AMD, INTEL)

Both AMD and Intel are trying to enter the GPU market, with AMD's Instinct line catching up to Nvidia's performance. AMD is also planning to release the MI300, an APU that packages a CPU and a GPU in a single chip die. AMD has also acquired Xilinx, adding FPGAs to their arsenal, which are reprogrammable and efficient for specific inferencing use cases. However,

AMD's software approach lacks coherence and they have fallen behind Nvidia in this area. Intel's oneAPI and OpenVino software platforms are hardware agnostic but are still in an early stage and are not as deep as CUDA. Moreover, as seen in the figures (Figure 11 & 12), Nvidia's new H100 is performance is comparable with AMD and Intel's Habana Gaudi2.

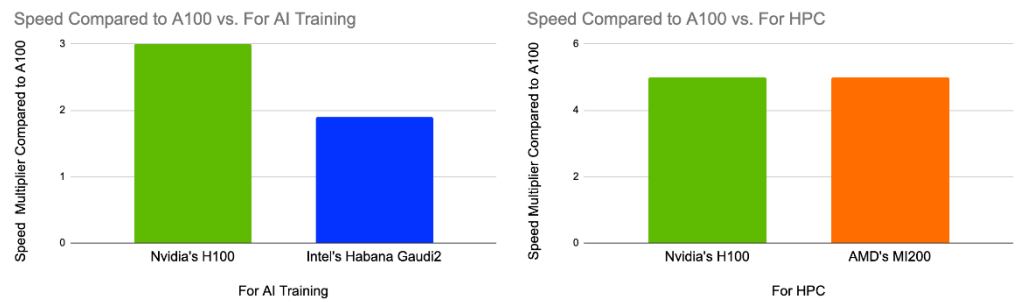


Figure 11 & 12, Source: Nvidia, AMD, Intel

## b. NVIDIA VS HYPERSCALERS (GOOGLE, AMAZON)

Google's Tensor Processing Units (TPUs) are custom-designed ASICs primarily used for Google's internal purposes and have limited use cases beyond Google's TensorFlow framework. TPUs account for about 11% of Google Cloud's accelerated instances, posing a small threat to Nvidia's business. Furthermore, Programming ASICs tends to be difficult, and they lack a mature software layer.

AWS has developed Inferentia and Trainium for inference and training, respectively, claiming better performance than Nvidia's GPUs. Despite Inferentia's share of AWS accelerated instances increasing over the last two years, causing Nvidia's share to decline from over 80% to 72% (Figure 13), Nvidia argues that optimising workloads with its TensorRT and Triton inferencing software makes their GPUs significantly better. Furthermore, they still hold the biggest share compared to competitors like AMD.

## c. STARTUPS (CEREBRAS, GRAPHCORE, AMONGST MANY OTHERS)

The Cerebras system, with a price tag of \$2-3 million, is primarily suitable for big enterprises that require mammoth AI training exercises. Due to its challenging deployment process, it is not economically viable for customers running standard, simpler AI models. Graphcore, another high-profile startup, uses wafer-on-wafer chip technology, but it is less cost-efficient than Nvidia. Although Graphcore has made significant improvements in MLPerf industry benchmarks, experts still question whether it is better than Nvidia from a performance-per-dollar perspective. On the other hand, according to SemiAnalysis, Nvidia's GPUs are flexible enough to run a wide range of models and use cases, making it the best option still for data centres that prioritise utilisation rates and have diverse AI needs.

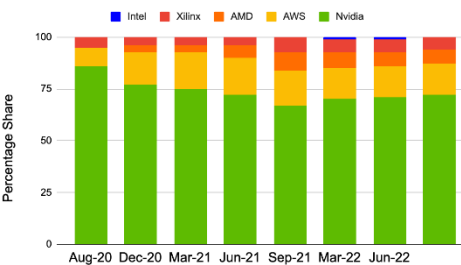
## NVIDIA'S HIGH FUTURE GROWTH

### NVIDIA'S FOCUS ON DATA CENTRE INDUSTRY

Nvidia's fourth-quarter revenue was \$3.62 billion, up 11% from a year ago, with fiscal-year revenue rising 41% to a record \$15.01 billion. They expect the data centre total addressable market (TAM) to more than double to \$50 billion by 2023, with businesses shifting toward the cloud and the volume of worldwide data increasing 1.8 times each year (Figure 15). Nvidia's GPUs are cost-efficient and customisable, making them attractive to data centre operators like Google cloud platform, which has seen a 1.5x revenue

Figure 13

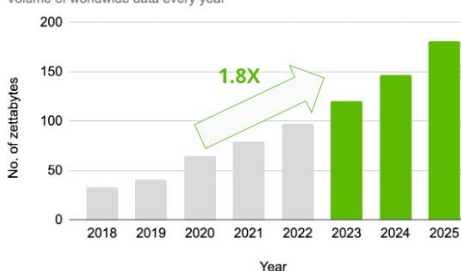
Dedicated Accelerator Instances Share at AWS



Source: Lifter Insights, Jefferies

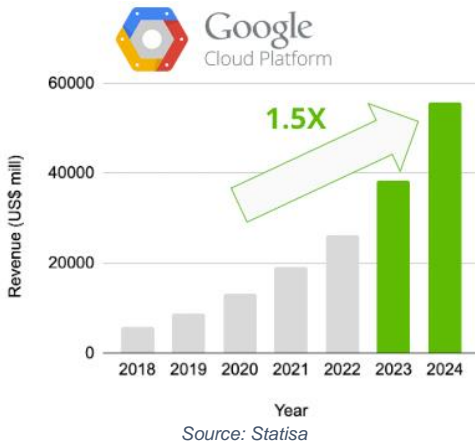
Figure 15

Volume of worldwide data every year



Source: Statista

Figure 16



increase over the years (Figure 16). Cloud service providers (CSPs) are the largest customer segment for Nvidia's data centre products, making it well-positioned for the expected growth in the data centre industry.

Nvidia has announced a partnership with Deutsche Bank to extend the use of AI in the financial services sector. Additionally, together with Dell Technologies, they launched 15 next-generation Dell PowerEdge systems available with Nvidia acceleration, enabling enterprises to use AI to efficiently transform their businesses. These moves further demonstrate Nvidia's focus on the data centre industry and its commitment to expanding its presence and revenue within this space.

## PROLIFERATION OF ARTIFICIAL INTELLIGENCE (AI) AUTOMATIVE INDUSTRY

The proliferation of Artificial Intelligence (AI) is rapidly increasing as businesses worldwide seek to integrate AI into their operations to streamline their processes, enhance efficiency, and gain a competitive edge. The AI market, valued at nearly \$200 billion in 2023, is expected to grow to \$795 billion by 2027 (Figure 17). This demand for AI infrastructure has led to an increased need for powerful graphics processing units (GPUs) which can perform complex computations and enable AI algorithms to process large amounts of data quickly.

As the leading provider of GPUs, Nvidia's suite of software and hardware products has enabled customers to build and deploy AI applications quickly and easily. Nvidia's customisable domain-specific AI solutions allow customers to find the right AI solution for their needs. Moreover, through Nvidia's cost-efficient AI workloads, customers can get the most value for their money when running their AI workloads. With the increasing demand for AI and machine learning technologies in various sectors, Nvidia's expertise and high cost-efficiency could position the company for significant revenue growth in the future.

Notably, Google Cloud Platform's data operations have expanded as the volume of worldwide data continues to increase every year, providing an excellent example of the growing demand for AI infrastructure. As businesses shift towards the cloud and the need for data centres increases, Nvidia's GPUs can offer the greatest cost-efficiency and customisability to data centre operators, enabling Nvidia to grab a large revenue from the TAM of the future growth in the data centre industry. Nvidia has also announced partnerships with Deutsche Bank and Dell Technologies to extend the use of AI in the financial-services sector and enable enterprises to use AI to transform their businesses efficiently.

### a. AUTOMATIVE INDUSTRY

The total addressable market (TAM) for the automotive industry is expected to be \$30 billion by 2025 with a projected revenue growth of 50% CAGR during the fiscal year 2023 to fiscal year 2025.

Leveraging on Nvidia's DRIVE software stack, Nvidia is able to facilitate the development and deployment of autonomous vehicle technology. Therefore, NVIDIA can take advantage of the high future growth in the autonomous industry and will be working with over 320 automakers to develop AI systems for self-driving vehicles. These collaborations will be

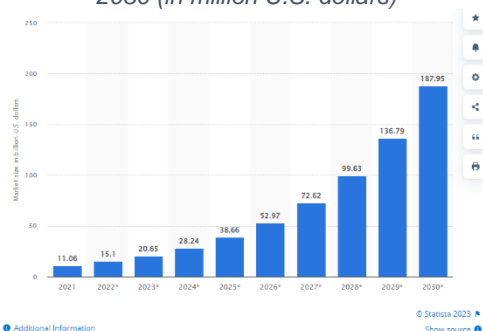
with leading automakers like Mercedes-Benz, BMW, and Audi. Which are set to reinforce Nvidia's position in the automotive industry market, and its focus on integrating AI into infotainment systems is generating revenue growth in autonomous driving.

Furthermore, Nvidia's automotive business segment is able to secure a 6-year pipeline worth USD\$ 11 billion. Which means that Nvidia's automotive industry segment is projected to reach USD\$ 2 billion in 2024. While Nvidia's total revenue in 2024 is estimated to be around USD\$ 30 billion according to Yahoo Finance. This would mean that, Nvidia's automotive industry could increase from the current 3% of Nvidia's revenue to 6% of Nvidia's future revenue in 2024. Therefore, the future of the Automotive industry could potentially have a great impact on Nvidia's revenue.

Source: Statista

## b. HEALTHCARE INDUSTRY

Figure 19: Artificial intelligence (AI) market size worldwide in 2021 with a forecast until 2030 (in million U.S. dollars)



NVIDIA has been expanding its presence in the healthcare industry by leveraging its GPUs and AI-powered platform called Clara, designed for healthcare applications. Clara enables healthcare providers to process and analyse medical data more efficiently, which can accelerate medical imaging, drug discovery, and genomics research. This investment in the healthcare industry is expected to generate significant growth, revenue, and profits for NVIDIA, as the global healthcare AI market is projected to be worth almost 188 billion U.S. dollars by 2030, increasing at a compound annual growth rate of 37 percent from 2022 to 2030 (Figure 19).

To further solidify its presence in the healthcare industry, NVIDIA has been collaborating with healthcare providers and pharmaceutical companies. For instance, the company partnered with the National Institutes of Health (NIH) in 2020 to develop AI tools to improve COVID-19 detection and diagnosis. NVIDIA's technology is already being used by healthcare providers and pharmaceutical companies such as the University of Florida and Bristol-Myers Squibb. The company also collaborated with AstraZeneca to develop AI models for drug discovery, further demonstrating NVIDIA's commitment to leveraging its AI technology in healthcare.

Moreover, global systems integrator Deloitte is helping solution providers worldwide to bring NVIDIA Clara to the healthcare ecosystem. The growing demand for AI-based technologies, the need to reduce healthcare costs, and the increasing volume of healthcare data are the factors that are expected to drive growth in the healthcare AI market. Therefore, NVIDIA's investment in the healthcare industry and collaborations with leading healthcare providers and pharmaceutical companies is likely to position the company for significant growth and revenue in the coming years.

## STRATEGIC ACQUISITIONS

NVIDIA has strategically acquired several companies to enhance its capabilities in key areas such as data centre networking, software development, and high-performance computing. In 2020, NVIDIA completed its acquisition of Mellanox Technologies, a leading supplier of high-performance networking and interconnect solutions for data centres. The acquisition has helped NVIDIA expand its data centre offerings, particularly in the area of high-speed networking. Mellanox's technology has also helped NVIDIA improve its overall performance and efficiency, making it a key player in the data centre industry. Additionally, in 2020, NVIDIA



Figure 20



Source: Nvidia

acquired Cumulus Networks, a provider of open networking software for data centres. The acquisition helped NVIDIA expand its networking software capabilities and accelerate the adoption of open, disaggregated networking solutions.

In 2013, NVIDIA acquired The Portland Group (PGI), a provider of high-performance parallel compilers and tools. The acquisition helped NVIDIA expand its software development capabilities, particularly in the area of high-performance computing (HPC). PGI's compilers and tools have also helped NVIDIA improve the performance and efficiency of its GPUs in HPC applications, making it a key player in this market.

Overall, these acquisitions have helped NVIDIA expand its offerings and improve its capabilities in key areas. These strategic moves have allowed NVIDIA to strengthen its position in these markets and increase its revenue and growth potential. For example, the acquisition of Mellanox has been a key catalyst for NVIDIA's data centre business, and the company expects its revenues from this market to grow at a CAGR of 24.5% through fiscal 2023-2025 (Figure 20).

## INVESTMENT RISK

While Nvidia has so far been consistently a step ahead in terms of hardware performance and flexibility, the risks from competition and potential disruptive trends also cannot be ignored. We will discuss some assumptions that have to hold for our reasonings to be true.

## NVIDIA'S COMPETITORS ARE UNABLE TO CATCH UP TO ITS LEVEL OF DOMINANCE

Nvidia faces increasing competition from a plethora of players in the data centre market. With the growing modularisation and outsourcing of large parts of the semiconductor supply chain, it has become increasingly easier to design and manufacture new chips, especially enabled in large part by Taiwan Semiconductor Manufacturing Company's fabrication prowess. This includes competition from established chip companies (e.g., AMD, Intel), hyperscalers (e.g., Google, Amazon) who have been pushing their own in-house designed chips, and startups (e.g. Cerebras, Graphcore). While Nvidia and its GPUs seem to be the technology of choice for the vast majority of AI workloads in the foreseeable future, these competitors do pose a longer-term threat to Nvidia's market share.

Especially for AMD, the more serious competitor to Nvidia with significant experience in the consumer GPU market. Its Instinct line of data centre GPUs is quickly catching up to Nvidia's performance and while NVIDIA still beats them in terms of software capabilities, there have been efforts in creating a more comprehensive software portfolio. With its recent Xilinx acquisition, AMD has been adding field programmable gate arrays to their data centre arsenal. The acquisition of Pensando has also further bolstered its presence in data processing units. The software push will fill a missing piece in AMD's road to becoming a one-stop shop for data centre offerings and will allow it to compete with Intel and NVIDIA in the data-centre market.

Thus, while NVIDIA's software ecosystem still gives it a strong competitive edge, we have to assume that NVIDIA's competitors are unable to make a surprise breakthrough with their continued efforts that might affect NVIDIA's market share and revenues in the coming year.



## NO DRASTIC EVENTS SIGNIFICANTLY AFFECT DEMAND OR SUPPLY, AND NVIDIA'S REVENUES

Last year, NVIDIA's stock price dropped on multiple occasions due to a multitude of reasons. For example, demand in the gaming market declined as the surge in demand seen through Covid-19 waned. Nvidia's inventory had too much stock and they had to slash prices. Nvidia had to follow their current pricing and overpriced their new 40-series GPU above the 30-series that angered its customers.

Also, Nvidia is not immune to geopolitical concerns. In October last year, the U.S. implemented regulations that banned exports of leading-edge AI chips to China. As a result, NVIDIA's sales to Chinese companies were impacted, which affected the company's revenue growth since business in China contributes about one-quarter of its revenue.

Therefore, while NVIDIA has since made adjustments and is recovering from such turbulence, we assume that either no such events will happen again or that NVIDIA is at least more prepared to handle them, and their stock price will not drop significantly.

## DEMAND FOR AI AND HPC WORKLOADS WILL CONTINUE TO BE ROBUST IN THE FUTURE

We assume that the demand for AI and HPC workloads will continue to be robust in the future. However, the recent success of ChatGPT has triggered an AI race, where countless companies have pivoted their businesses to AI development, increasing demand for powerful hardware like Nvidia's graphics processing units (GPUs). Thus, while NVIDIA's success does rely on the future of this market, we believe it is more likely that the assumption will hold true and allow for NVIDIA's growth in this market.

## VALUATION

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From our financial analysis, we estimate the growth in group Nvidia's valuation ratio, which measures a market price in relation to an accounting metric, can help investors gauge the company's relative value and compare it with historical trends. One commonly used ratio is the Price to Earnings (P/E) ratio, which divides the market price per share by the earnings per share (EPS) over a given period, usually the past 12 months.

As of the time of writing, Nvidia's highest P/E ratio for the trailing 12 months is 84.57, while the current P/E ratio stands at 81.44. Based on the company's current EPS of \$3.95 (derived from its net income and outstanding shares as of 2022), we can use the P/E ratio formula to estimate a potential price for Nvidia (Figure 14).

This implies that Nvidia has a potential price of \$334.05, which represents a 23% increase from its current price of \$271.

Figure 14

$$\begin{aligned} P/E \text{ Ratio} &= \frac{\text{Market Price Per Share}}{\text{Earnings per share}} \\ \text{Market Price Per Share} &= P/E \text{ Ratio} * \text{Earnings Per Share} \\ \text{Market Price Per Share} &= 84.57 * 3.95 \\ \text{Market Price Per Share} &= \$334.05 \end{aligned}$$

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