

Research on the Competitive Development and Prospects of Nvidia

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Abstract: With the rapid development of technologies such as artificial intelligence (AI), deep learning and high performance computing (HPC), Nvidia has gradually become the technology company with the upper hand in the world in the last decade with its technical advantages in the graphics processing unit (GPU) field. The purpose of this article is to analyze the future development prospects of Nvidia and explore its competition and challenges in the AI and GPU markets. Through the review and analysis of existing literature, combined with NVIDIA's financial data, SWOT analysis and industry environment assessment, the main opportunities and threats facing the company are revealed. The research shows that despite Nvidia's dominant position in GPU technology and AI, its future growth faces challenges from different aspects, including competitive pressure in the core market (GPU), bottlenecks in technological progress, saturation of the gaming graphics card market, and supply chain risks. The conclusion is that Nvidia's long-term growth prospects remain strong, especially in high-potential areas such as artificial intelligence and autonomous driving. However, with the rise of competitors such as AMD and Intel, as well as uncertainties in the global economy and supply chain, Nvidia will face fierce market competition. Therefore, Nvidia should continue to increase its technological innovation efforts, optimize supply chain management, and strengthen its strategic positioning in new technology areas. Nvidia may encounter many challenges in the next few years, but relying on its strong technological innovation capabilities, extensive market applications and strategic layout, it still has huge development potential.

Keywords: Artificial Intelligence (AI), Graphics Processing Unit (GPU), Market competition, Technological innovation, Autonomous driving.

1. Introduction

In recent years, artificial intelligence as a kind of high technology has spread rapidly all over the world. More and more multinational technology companies are developing and researching in the field of artificial intelligence. Nvidia is known for its high-performance graphics processing units, which were originally used for graphics rendering, such as video games and special effects. Today, Nvidia's graphics processing units are often found in artificial intelligence, deep learning, high-performance computing (HPC), and scientific research. Nvidia plans to accelerate its footprint in data centers, autonomous driving, virtual reality, and other related graphical computing areas, and use its strong cash reserves and revenue growth to support further development of these projects. These

strategies form synergies with its core AI business and play an important role in securing its market leadership and technology. However, the high valuation of Nvidia's share price has increased the pressure on the market's expectations for its future growth. If operations fall short of expectations and demand for generative AI and large models slows, which could lead to a decline in investor confidence, Nvidia's business relies heavily on growing demand in the AI and GPU markets. Not only that, the gaming graphics market as its core area of growth may be saturated, and this area is still a significant source of revenue for Nvidia.

Previous research has provided a detailed analysis of Nvidia's financials. Many people think that the risk assessment of Nvidia's investment is still to be considered. Zhao has pointed out that although Nvidia has many advantages and development opportunities, it also faces threats and challenges [1]. By analyzing factors such as annual reports, financial data, relative valuations, policy support and media information, Nvidia is not suitable for investment in the short term[1]. When regarding the semiconductor industry, Wang has thought that the semiconductor industry is affected by technological development, epidemic and international situation, and now faces the coexistence of risks and opportunities [2]. Because of the high stock price and enterprise value of NVIDIA, this paper evaluates Nvidia and uses the SWOT method to put forward five suggestions such as transforming the supply chain of the game market [2]. The conclusion is that NVIDIA is overvalued, and these suggestions have reference value for semiconductor companies with technological advantages [2]. Chen also concluded that Nvidia performed well in revenue growth and profitability, solidifying its leadership position in Gpus, artificial intelligence and data centers, and showing significant potential for return on investment [3]. At the same time, investment strategies such as hedging and diversification are mentioned, and risk avoidance advice is provided for investors [3]. The conclusion is that Nvidia has good investment potential, but investors need to assess risk tolerance and adopt effective risk mitigation strategies to cope with the dynamic technology environment [3]. However, most investors, managers and academics are still debating NVIDIA's business status and future development trends. Qin and Tian have proposed that based on NVIDIA's financial data from 2018 to 2023, the company is comprehensively analyzed from four perspectives, including strategy, using the Harvard analysis framework. By constructing a model at the strategic level to study the key indicators at the accounting and financial level, it is found that NVIDIA performs well in terms of solvency, profitability, operating ability and growth ability [4]. It should be noted that AMD is one of Nvidia's main competitors, and both companies have undergone strategic adjustments in the face of technological advances and changing market demands. While NVIDIA relies on its strength in the GPU market, it equally needs to constantly adapt to emerging technologies and changes in the market [5]. NVIDIA and AMD are both in important positions in the semiconductor industry, but their strategic directions are different: AMD has refocused on high-performance computing and processors in recent years and successfully transformed through Lisa Su's leadership; NVIDIA has strengthened its leadership in the high-performance computing market through continued innovation and strategic acquisitions in graphics processing units (GPU) and artificial intelligence (AI) [5]. Meanwhile, Qi also argues that driven by technological innovation and market demand, Nvidia's revenue and stock price have soared in a short period of time[6]. In order to accurately assess the true value of Nvidia, models such as Pro Forma, DCF and intrinsic valuation methods are used for financial analysis and forecasting [6]. By summarizing, it finds that Nvidia's actual intrinsic value is still higher than the current market price. However, business valuations are subject to many uncertainties [6]. There is no denying that Nvidia currently has many advantages in the global gaming GPU industry. While previous research has focused on technology, investments, and some specific financial ratios, few studies have focused on Nvidia's financial statements and industry environment [7]. By in-depth analysis of Nvidia's income statement and balance sheet in the 2022-2024 fiscal year with the industry environment SWOT[7]. We concluded that Nvidia's financial

position is strong and that it is in a stable position in a highly competitive market. The company is well positioned not only in the industry environment but also in the consumer market [7]. WANG and the four also mentioned that Nvidia has become an industry leader and redefined computing power through innovation in GPU technology, and has a significant position in the highly competitive AI and GPU market for different uses [8]. It also highlighted the collaborative benefits of Nvidia's developer ecosystem and its critical role in market disruption [8]. By exploring the internal and external factors such as Nvidia's innovation culture and risk-taking spirit, analyze the reasons that drive its success [8]. During the COVID-19 pandemic, NVIDIA-produced graphics cards experienced a very severe shortage, which dealt a heavy blow to the global GPU market. The graphics card shortage is a complex issue, not just because of COVID-19, but also because of the vulnerability drivers in the design of the supply chain that play an important role in the emergence of risk [9]. When relevant information has been gathered through archival and literature studies, rely on secondary data sources such as journal articles, organizational reports, journal articles, etc., to identify risk and vulnerability factors[9]. The analysis shows that the pandemic, as a trigger event, exposes vulnerabilities in the design of supply chain risks, leading to risks such as supply capacity problems, transportation difficulties, and demand surges [9]. In addition to the financial situation, considering the rapid development of cloud gaming platforms today, Nvidia has consolidated its absolute dominance in the gaming industry through the efforts of streaming gaming platforms, but there are many challenges that have an adverse impact on Nvidia's continued expansion. The NVIDIA GeForce NOW gaming streaming platform is a cloud gaming platform developed by Nvidia for users of GeForce gaming graphics cards. Cloud games as a highly interactive service, the game logic is rendered in the cloud and transmitted to the terminal device in the form of a video stream, although it can stream high-quality graphics games to almost any terminal device, it also faces the challenge of high bandwidth requirements and extremely low latency[10]. Therefore, cloud gaming service providers need to design algorithms that adjust video streaming parameters to fit the limitations of end devices and network resources [10]. In the case of frequent fluctuations in global bandwidth latency, it is a long-term problem for Nvidia.

Through the comprehensive exploration of Nvidia's financial situation analysis and internal technological innovation in recent years, this paper discusses the measures NVIDIA should take in the future and the challenges it may encounter.

2. SWOT

2.1. Strengths

Nvidia has several strengths. Firstly, Its technology is leading the industry. NVIDIA is a major leader in the GPU (graphics processing unit) space, and in particular, dominates the market for high-performance gaming graphics cards and high-performance computing (HPC). Nvidia's proud CUDA platform provides powerful support for the development of artificial intelligence (AI) and deep learning. Secondly, it has a powerful brand. NVIDIA is a well-known brand in graphics computing and AI that is highly recognized by developers, enterprises, and consumers. Especially in the game industry, there is a considerable market share. Moreover, It has diversified market applications. Outside of gaming, in industries such as data centers, autonomous vehicles, medical image processing, and the Metaverse, NVIDIA's technology is already widely used in technologies related to computing needs. By contrast, It has huge R&D investments. NVIDIA invests a large amount of revenue into research and development each year to drive innovation in its own technology. This continued high investment has enabled the company to develop industry-leading GPU and AI computing platforms such as CUDA and Omniverse. Not only that, but it can also maintain a technological advantage in the competition for a long time.

2.2. Weakness

Nvidia also has some weaknesses that already exist. Inevitably, it is heavily dependent on specific markets. Although NVIDIA has diversified, its core revenue still comes from the gaming graphics market and data center business. If these markets show a downward trend, the company may face financial stress. It is noteworthy that its high-end products are often accompanied by high product prices. NVIDIA's higher-priced high-end products, such as the RTX4090 gaming graphics card, could see sales decline due to a lack of consumer purchasing power, especially in a recession. Supply chain complexity is also a disadvantage to be aware of. Because NVIDIA does not manufacture chips directly, it relies on foundries such as Taiwan Semiconductor Manufacturing Company (TSMC) for production. As a result, problems at any point in the supply chain, such as raw material shortages, capacity constraints, or geopolitical conflicts, can lead to delays in the supply of products or increased costs. In addition, this highly dependent foundries model also gives NVIDIA less control over the supply chain and may face more challenges as competition intensifies in the chip industry. There may be aftermarket and technical architecture limitations. For example, AI technology involves complex algorithms and models, and traditional after-sales support may not be able to provide deep enough technical support once problems arise. The architecture of some technology platforms may not be flexible and scalable enough to effectively support the training and deployment of large-scale AI models.

2.3. Opportunity

There is no denying that there are many opportunities for Nvidia. The rapid growth of the artificial intelligence and machine learning market has laid the big picture for Nvidia. The wide application of AI has the demand for powerful computing power, and NVIDIA's GPU and related software platforms have irreplaceable advantages, and the market potential is huge. With the rapid development of autonomous driving technology in the last decade, the demand for high-performance computing and AI processing power in the electric vehicle industry has exploded. NVIDIA's DRIVE platform provides powerful GPU and AI algorithm support to efficiently perform tasks such as perception, decision-making, and navigation in autonomous driving. This makes NVIDIA an important partner for many automakers and technology companies. In the future, as the autonomous vehicle market continues to expand, this area will bring significant growth potential for NVIDIA. The rollout of 5G networks will significantly increase data transmission speed and computing power, driving the development of related projects such as cloud computing, edge computing, and the Internet of Things. NVIDIA's high-performance Gpus will play an important role in the computing needs of these areas with their powerful computing power, so the popularization of 5G brings more application scenarios and market expansion opportunities.

2.4. Threats

Nvidia is still under threat from all sides. The first is increased competition in the market. The rapid growth of competitors such as AMD and Intel in the GPU and AI markets could eat into NVIDIA's market share, and AMD's high-performance gaming graphics cards have a price advantage when compared to NVIDIA's comparable products. In addition, tech giants such as Google and Amazon are also developing chips to enter the GPU chip market. It could be subject to regulatory and geopolitical risk. NVIDIA's business covers the world, but it has been affected by geopolitical tensions, such as increased technology competition in the US-China situation and changes in export control policies. The U.S. government may restrict NVIDIA's exports of high-performance chips to certain countries, such as China, which will have a direct impact on the company's sales activities in these geographic markets.

3. Prospects

Based on previous analysis and stock market reaction, it can be inferred that Nvidia's future is considerable with large probability. These data and the performance in recent years can be used to predict NVIDIA's development from multiple perspectives. Nvidia continues to grow in the areas of artificial intelligence and deep learning with its powerful GPU technology, and has become a core enabler in these areas. In the next decade, as the application of artificial intelligence continues to deepen, the need for Nvidia to provide high computing power support will continue to grow, especially in areas such as autonomous driving. It is worth mentioning that gaming has always been Nvidia's core business, and with the GeForce series of Gpus and years of experience in this field, Nvidia has firmly occupied the global gaming market leadership. With the development of cloud gaming and virtual reality (VR) and augmented reality (AR) technologies, Nvidia's technology will be widely used in these emerging entertainment sectors. At the same time, the rise of cloud gaming has allowed players to no longer rely on local hardware, but rather remote gaming experiences transmitted through non-local cloud computing platforms. Nvidia is likely to further expand its footprint in gaming cloud services and in-store gaming high-performance graphics cards, boosting its market share in the gaming space. It should be noted that Nvidia, despite its excellent performance in multiple areas, may encounter some trouble from various aspects in the future development process. By contrast, Nvidia needs to face fierce market competition from many parties. Technological advances by competitors such as AMD and Intel in Gpus and high-performance computing have hampered Nvidia's progress in the same area. AMD's rise in graphics processing and data centers, especially in gaming and AI, has put strong competitive pressure on Nvidia, such as the performance difference between AMD's RX7000 series gaming graphics and Nvidia's RTX 40series gaming graphics. Intel is also increasing its investments in AI chips and semiconductors. As competition intensifies, Nvidia could face market share compression, especially in terms of price-performance and product innovation. There are other reasons to affect the development of NVIDIA, and global economic fluctuations are also one of them, such as trade wars, economic recession, inflation and other factors may adversely affect Nvidia's sales, production costs and global expansion plans. In addition, supply chain issues (such as chip shortages, logistics difficulties, etc.) have affected many semiconductor companies and chip manufacturing companies such as TSMC and Samsung in the past few years, and Nvidia has not been completely immune. Even after two years away from the pandemic, the recovery of the global supply chain remains uncertain due to factors beyond our control that could affect Nvidia's product delivery and production efficiency. Nvidia's future development is full of potential, but it also faces many challenges. Market competition, technological innovation pressure, supply chain risks, policy changes, and industry ethics can all affect its long-term development.

4. Conclusion

In this paper, the future development of NVIDIA has been studied and some relevant conclusions have been drawn. Nvidia's leadership in artificial intelligence (AI) and graphics processing units (GPUs) and the market pressures facing the company were discussed. It also reviewed the literature on Nvidia's financial analysis, market risk, competitive situation, etc. An analysis of Nvidia's SWOT reveals Nvidia's market position and possible challenges. Therefore, the future development trend of NVIDIA is predicted and various external and internal factors that may affect its growth are discussed. It is found that Nvidia has strong competitive advantages in high-performance computing, autonomous driving, virtual reality and other fields. Although Nvidia is expanding in several areas, such as data centers, autonomous driving, etc., its core revenue still relies on gaming graphics cards and data center business. As a result, a downturn in any of these core markets could affect its financial performance. It also found that the rise of competitors such as AMD and Intel in high-performance

computing and AI chips poses a growing challenge to Nvidia, especially in the battle for share in the graphics card and data center markets. At the same time, such as global economic fluctuations, geopolitical risks (such as the US-China trade war), supply chain issues, etc., may affect Nvidia's global expansion and product delivery efficiency. In the future, Nvidia should maintain its technological innovation in GPU and AI, and increase its presence in other high-potential markets to achieve long-term sustainable growth and a greater focus on supply chain stability. In the face of price wars, technological innovation and market strategy challenges from powerful competitors such as AMD and Intel, Nvidia needs to continue to invest in research and development, not only to make breakthroughs in price performance, but also to strengthen market share in gaming, data center and other fields.

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