

## CHAPTER IV FINDINGS AND DISCUSSION

### 4.1. Financial Trends and Valuations of the GPU Market

The evolution of the GPU market represents a fascinating correlation between companies' financial performance and the technological advancements made. Initially only aiming to fulfill the demands of the gaming and multimedia industry, the industry's growth is further accelerated by the involvement and dependence of AI on GPU technology. As of 2024, the industry is forecasted to reach USD 450.9 Billion by 2030 based on its valuation (REPORTSINSIGHTS CONSULTING PVT LTD, 2023).

The add-in-board (AIB) -which are independent GPU chips that can be added to a computer to improve its performance- market's current leaders are NVIDIA, AMD, and Intel respectively, with NVIDIA being the leader at 80% market share, AMD at 19% and Intel 1% (Dow, 2024). This market share highly fluctuates due to the highly competitive nature of the industry, where if a company was able to create a slightly better product, it would gain a significant market share.

As the current biggest AI chip producer, with over 80% of the market share as of early 2024, NVIDIA's share price surged by almost 450% from January 2023 to February 2024 (The Economist, 2024). As of the writing of this paper, NVIDIA's market cap stands at USD 2.149 Trillion, with each share priced at USD 859 (Nasdaq, NVIDIA Corporation (NVDA), 2024). Meanwhile, the second biggest competitor, AMD, is currently valued at USD 312 Billion, with each share priced at USD 191 (Nasdaq, Advanced Micro Devices, Inc. (AMD.F), 2024).

Another comparable aspect between the two market leaders is the revenues they made from their businesses. In 2023, NVIDIA's revenue was USD 15 billion from data centers, USD 9.1 billion from gaming, USD 1.5 billion from professional visualization, and USD 0.9 billion from automotive, with a total combined revenue of USD 27 billion coming from other revenue streams the company had (NVIDIA, 2023). On the other hand, AMD's revenue was 22.7 billion, with USD 6.5 billion from data center revenue, USD 4.7 billion from client revenue, USD 6.2 billion from gaming revenue, and USD 5.3 billion from embedded revenue (AMD,

2023). This significant difference between NVIDIA and its competitor demonstrates the immense growth and market confidence in NVIDIA since its establishment. However, this was not always the case, as both NVIDIA's share price and market share did accelerate hugely due to the advancements, they made which its competitors could not replicate.

Notably, NVIDIA's GPU chips' ability to be easily programmed and deliver high-performance computing power, which is very suitable for the promising AI industry accelerated and cemented the company's position. Furthermore, NVIDIA's strategy, to invest in AI earlier than other companies did prove to pay off well. This strategy is still being reflected based on the company's 2023 financial statements stating they have invested in various AI-related companies.

The following is what NVIDIA has invested in, in the 2023 financial statements:

1. Accelerated Computing: NVIDIA focuses on full-stack invention, from chips and systems to applications, emphasizing accelerated computing to solve complex problems.
2. AI and Generative AI: The company invests in AI technologies, including generative AI, which is considered a new computing platform.
3. Healthcare and Automotive: NVIDIA's Clara healthcare application framework and Omniverse for automotive metaverse are key investment areas.
4. Chip Design and Manufacturing: Investments in computational lithography and partnerships with companies like TSMC, ASML, and Synopsys highlight NVIDIA's commitment to advancing chip design and manufacturing.

#### **4.2. Financial Performance Analysis of NVIDIA**

Three analyses will be done on NVIDIA's company performance, a financial statement analysis, then followed by a first screen test comprising of the P/E and the dividend yield analysis will be done to identify the general position of the company. Apart from the 5-year trend analysis, the data that will be used to conduct the research will be NVIDIA's 2023 Q4 Form 10-Q sheet, representing the company for the fiscal year that ended on January 28, 2024.

#### 4.2.1. Peer Comparison

*Table 4.1 Peer Comparison of the 3 Biggest Companies in the Semiconductor Industry*

Company	P/L for period [Net income]	Profit margin	Total Revenues	ROE using P/L before tax	Enterprise value	EBITDA
NVIDIA CORP	29,760,000	55.51	60,922,000	78.69	1,503,441,948	35,103,000
INTEL CORP	1,689,000	1.41	54,228,000	0.72	236,086,000	9,633,000
ADVANCED MICRO DEVICES INC	854,000	2.17	22,680,000	0.88	232,551,006	3,820,000
Average	8,081,524	20.21	35,985,677	25.24	341,549,996	12,913,342

From the peer comparison of firms competing in the semiconductor industry, based on the 2023 fiscal year data, NVIDIA can be seen as the biggest company based on net income, profit margin, ROE, and enterprise value. We can infer that the company is performing significantly better than others. Furthermore, it must be noted that Taiwan Semiconductor Manufacturing (TSMC) is a company that creates semiconductors and acts as a B2B<sup>8</sup> business that does not compete directly with NVIDIA on the market. This further emphasizes NVIDIA's domination in the industry through not only market share but also financial performance.

#### 4.2.2. 5-Year Trend Analysis

*Table 4.2 5-year Trend Analysis of NVIDIA*

Fiscal Year	Revenue (in millions)	Cost of Revenue (in millions)	Gross Profit (in millions)	R&D Expenses (in millions)	Operating Expenses (in millions)	Operating Profit/Loss (in millions)	Net Income (in millions)	Net Margin
2019	11,716	4,545	7,171	2,376	3,367	3,804	4,141	35.35%
2020	10,918	4,150	6,768	2,829	3,922	2,846	2,796	25.61%
2021	16,675	6,279	10,396	3,924	5,864	4,532	4,332	25.97%
2022	26,914	9,439	17,475	5,268	7,434	10,041	9,752	36.24%
2023	26,974	11,618	15,356	7,339	11,132	4,224	4,368	16.19%

<sup>8</sup> Business to Business firm, selling products for other companies

A five-year trend analysis of NVIDIA's financial performance was conducted to assess how the company's stock has responded during a period whereby a significant advancement in artificial intelligence (AI) happened. This timeframe was chosen also because it coincides with the rise of AI as a transformative technology, a period characterized by an increase of the enthusiasm investors and a significant interest in AI-related innovations. Given NVIDIA's critical role as a leading producer of GPUs, which are essential for AI development, examining the company's financial and stock performance during this period offers valuable insights into how the AI surge has influenced investor behaviour and NVIDIA's market valuation.

#### **4.2.3. First Screen Test**

Based on the financial 2023 Q4 Form 10-Q statement, and the current share price as of 5/6/2024 at 887.83 USD per share, NVIDIA's P/E ratio is 74.43, with the EPS of 11.93 USD per share, and the dividend yield of 0.018%.

With a P/E of 74.43, NVIDIA is valued extremely high when compared to the semiconductor industry's P/E ratio of 31.59 (Damodaran, 2024). This suggests that investors are willing to pay a substantial premium for NVIDIA's stock because of their high expectations for future growth and profitability. It indicates strong market confidence, but it also means that the has a high tendency to be overvalued.

The dividend yield is around 0.018%, which is extremely low. This aligns with NVIDIA's strategy to reinvest earnings into growth opportunities rather than distributing them as dividends. It suggests that the company prioritizes long-term value creation through R&D and market expansion rather than immediate returns to shareholders.

Based on the EPS result of 11.93, significant profitability and the ability to generate strong earnings for each share. This high EPS number also aligns with the company's rapid growth in the semiconductor and its relevance with the highly developing AI industry.

#### 4.2.4. Multiples Comparison

The following are NVIDIA's multiples compared to Intel and AMD as the company's biggest competitors within the industry.

*Table 4.3 Multiples of NVIDIA, Intel and AMD*

Company	P/E	EV/EBITDA	EPV
NVIDIA CORP	74.43	42.83	44.1
INTEL CORP	32.19	24.51	-38.37
ADVANCED MICRO DEVICES INC	221.47	60.88	9.55

The EPV was calculated with the assumption that the tax rate for the companies was achieved through the average tax rate of the previous 5 years, with the average tax rate of each company as based on the EPV model provided by GuruFocus (Tian, 2024).

#### 4.2.5. DCF Analysis

*Table 4.4 DCF Analysis of NVIDIA*

Account	Year 1 (in billions)	Year 2 (in billions)	Year 3 (in billions)	Year 4 (in billions)	Year 5 (in billions)
Revenue	113	139	166	197	222
Operating Margin	113	139	166	197	222
<b>Operating Income</b>	<b>69</b>	<b>86</b>	<b>102</b>	<b>121</b>	<b>136</b>
Tax	9	11	13	16	18
<b>NOPAT</b>	<b>78</b>	<b>97</b>	<b>115</b>	<b>137</b>	<b>154</b>
Capex	2	-2	3	3	3
<b>FCFF</b>	<b>80</b>	<b>95</b>	<b>118</b>	<b>140</b>	<b>157</b>
<b>Discount Rate</b>	<b>11%</b>	<b>11%</b>	<b>11%</b>	<b>11%</b>	<b>11%</b>
<b>Present Value</b>	<b>72</b>	<b>77</b>	<b>87</b>	<b>92</b>	<b>93</b>

Present Value	1.8T USD
+ Cash & Equivalents	7.3B USD
+ Investments	20.3B USD
Firm Value	1.9T USD
- Debt	8.5B USD
Equity Value	1.9T USD
Shares Outstanding	2.5B USD
NVDA DCF Value	745.66 USD

From the DCF analysis utilizing assumptions calculated from both the previous year's data, as well as numbers provided by GuruFocus (Tian, 2024), and model provided by (Alpha Spread Limited, 2024), we can infer that NVIDIA's NVDA share is overpriced, as of now, 6<sup>th</sup> of May 2024, the share is valued at 887.83.

However, it must be noted that the conclusion of NVIDIA's share price being overvalued does not mean that the shares are not worth investing in. Especially considering the different objectives of investing that may differ depending on the investors.

### **4.3. Event Study Methodology**

Throughout NVIDIA's existence, the company's stock has been heavily impacted by the advancements the company has made in the industry, which is reliant on technological improvements. This is proven from multiple occasions in the company's history, whenever they launched their latest products or made a strategic decision that affected the public's opinion of the company.

The company has had a long list of product launches that were not very successful, especially at the beginning of the company's history. As mentioned in the introductory part, their first products, such as the NVIDIA NV1, NVIDIA RIVA128, NVIDIA RIVA TNT, NVIDIA VANTA, and NVIDIA QUADRO, were steps for the company to gain advantages in their technology, as well as market share. However, these products were launched before their initial public offering, and there was no available data made to the public, whether it was sharing prices or periodical financial statements.

On January 22<sup>nd</sup>, 1999, NVIDIA completed its IPO with the share price of USD 12 per share (Pizio, 2023), or USD 0.45 per share after considering stock splits. This was before the company had launched its first groundbreaking technology, the NVIDIA GeForce 256, which was released to the public on October 11<sup>th</sup>, 1999. It was probable that the market's initial reaction to this launch was positive, as there was a price surge from October 8<sup>th</sup>, 1999, to October 11<sup>th</sup>, 1999, on the launch day. However, the two days of unavailable data may leave some other speculative reasons as to why the share's price increased.

Following the introduction of the GeForce 256, NVIDIA made the next significant advancements in 2006 with the CUDA<sup>9</sup> architecture. This innovation allowed NVIDIA's GPUs to gain a substantial advantage over competitors' products, revolutionizing how processing tasks were distributed and executed. The architecture was applied on the new NVIDIA GeForce 8800 on the 8<sup>th</sup> of November 2006 (GamesIndustry International, 2006). Similarly, the day after the new product was launched, the share price increased from USD 5.64 on the 8<sup>th</sup> of November, to USD 5.89 on the 9<sup>th</sup> of November 2006.



*Figure 4.1 NVIDIA share price following launch of NVIDIA GeForce 8800 (Resource: Yahoo Finance)*

The next monumental event that may have impacted NVIDIA is the 2012 Alexnet AI creation. The AI advancement was created by students at the University of Toronto who utilized NVIDIA's GPUs for the ImageNet Large Scale Visual Recognition Challenge, which ended on October 13<sup>th</sup>, 2012. Though this advancement was indeed a huge leap in technology that affected the company, it does not seem to have a significant impact on the prices of NVIDIA's shares. This is seen from the price of NVDA on 12<sup>th</sup> October 2012 opened at USD 3.16 and stayed the same on 15<sup>th</sup> October 2012, at USD 3.16 (Yahoo Finance, 2024). The shares also did not rise significantly following the role of NVIDIA's GPU in the company.

<sup>9</sup>Parallel computing platform and programming model created by NVIDIA



Figure 4.2 NVIDIA share price following Alexnet AI (Resource: Yahoo Finance)

On the 20<sup>th</sup> of September 2018, NVIDIA launched its next breakthrough product which was the NVIDIA RTX GPUs that used a different architecture for its GPU and introduced ray-tracing technology. The GPU’s performance was also greatly improved compared to its predecessors and in almost every aspect better than their competitors’ products. However, despite this breakthrough, NVIDIA’s share price instead fell from its opening at \$70 per share on the 1<sup>st</sup> of September 2018, before the RTX launch, to \$53 per share, around one month after the launch of RTX.



Figure 4.3 NVIDIA share price following RTX launch (Resource: Yahoo Finance)

The next significant event that may have a significant impact on the company’s share is the release of the currently most used AI platform, which is OpenAI’s ChatGPT, which was published on the 30<sup>th</sup> of November 2022. The AI platform utilizes NVIDIA’s GPUs as its engine, which is why it should be relevant to NVIDIA’s share price and the market’s perception of the company. There seems to not be any direct impact on the company’s share from the release of ChatGPT. However, this may be due to the popularity of the AI platform itself which has not reached its current heights.



Figure 4.4 NVIDIA share price following ChatGPT release (Resource: Yahoo Finance)

Thus, despite advancements within the industry, NVIDIA’s share prices did not always rise positively. Furthermore, out of all the 4 previously mentioned events, the two closest NVIDIA-related launch events were the RTX launch and the ChatGPT launch, thus the two will be the events which that Theil’s nonparametric regression is going to be applied to.

### 4.3.1. RTX Launch

Table 4.5 Wilcoxon-Signed Rank Test on RTX Launch

Day	Adj. Close	Return	ABS Return	Rank	Signed Rank
-10	6.508.546	3,311%	3,311	12	12
-9	6.608.099	1,090%	1,09	7	7
-8	6.741.330	1,577%	1,577	9	9
-5	6.832.462	0,913%	0,913	5	5
-4	6.794.821	-0,990%	0,99	6	-6
-3	6.900.375	1,114%	1,114	8	8
-2	6.883.527	-0,683%	0,683	3	-3
-1	6.954.639	0,594%	0,594	1	1
0	Launch	N/A			
5	7.029.467	N/A			
6	6.898.640	-2,300%	2,3	10	-10
7	6.757.406	-2,486%	2,486	11	-11
8	6.736.098	-0,755%	0,755	4	-4
9	6.807.209	0,616%	0,616	2	2
	CAR	2,001%		W+	44
				W-	-34

For  $n = 12n$  non-zero observations, and using a significance level  $\alpha = 0.05$  (two-tailed), the critical value from the Wilcoxon Signed-Rank table is 13. Since  $T = 34$  is greater than the critical value 13, the results fail to reject the null hypothesis. This means that there is no significant difference between the paired observations.

#### 4.3.2. ChatGPT Release

*Table 4.6 Wilcoxon-Signed Rank Test on ChatGPT Release*

Day	Adj. Close	Return	ABS Return	Rank	Signed Rank
-8	15.304.317	-1,3%	1,3	3	-3
-7	16.024.717	4,0%	4	11	11
-6	16.505.322	2,3%	2,3	8	8
-5	16.256.527	-2,2%	2,2	6	-6
-2	15.813.893	-3,4%	3,4	10	-10
-1	15.626.048	-1,9%	1,9	5	-5
0	16.913.311				
1	17.125.189	0,6%	0,6	2	2
2	16.866.335	-2,2%	2,2	7	-7
5	16.600.494	-2,3%	2,3	9	-9
6	15.977.847	-4,4%	4,4	12	-12
7	16.110.771	0,1%	0,1	1	1
8	17.159.174	5,8%	5,8	13	13
9	16.991.268	-1,7%	1,7	4	-4
	CAR	-6,4%		<b>W+</b>	<b>35</b>
				<b>W-</b>	<b>-56</b>

For  $n = 13n$  non-zero observations, and using a significance level  $\alpha = 0.05$  (two-tailed), the critical value from the Wilcoxon Signed-Rank table is 17. Since  $T = 35$  is greater than the critical value 17, the results fail to reject the null hypothesis. This means that there is no significant difference between the paired observations.

To summarize, on both occasion The Wilcoxon Signed-Rank Test was applied, the results was a test statistic (T) that was compared to a critical value. The comparison showed that the test statistic was greater than the critical value, leading to the conclusion that there was no significant difference in stock returns before and after the event.