LISBON SCHOOL OF ECONOMICS & MANAGEMENT
UNIVERSIDADE DE LISBOA

# MASTER OF SCIENCE IN
FINANCE

# MASTERS FINAL WORK
PROJECT

EQUITY RESEARCH:

# NVIDIA CORPORATION

PEDRO MIGUEL RODRIGUES GAMEIRO

SEPTEMBER 2018

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**SUPERVISOR:**

PROFESSOR DOUTOR PEDRO RINO VIEIRA

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## Abstract

This project reflects an evaluation of NVIDIA Corporation, Semiconductor Company, according to ISEG´s Master in Finance final work project. This report was written in agreement with the recommendations of the CFA Institute. NVIDIA is a company that is facing a very singular moment comparing to its peers, with a 40% annual revenue growth and a valuation increase of 334,46% in the last two years. Not only NVIDIA is having an interesting financial performance but also is entering in emerging markets, such as, autonomous cars and cryptocurrencies, being a very interesting case study. Also the fascination about technology and gaming in specific was one of the reasons this company was chosen. This report was developed considering public information available until June 30th 2018 and any information or event subsequent to this date has not been considered. The price target of $303,67 was obtained from the Discounted Cash Flow method. The relative valuation method was attempted, but due to the unique situation of NVIDIA, there are not close peers following the criteria's used. This valuation suggests to a BUY recommendation, although with medium risk, since NVIDIA is consolidated in their main market, gaming, but there is some uncertainty relatively to markets like cryptocurrency and autonomous cars.



JEL classification: G10; G32; G34; G39

Keywords: Equity Research; Valuation; NVIDIA Corporation; Semiconductor; Graphic Cards, Cryptocurrency;

## Resumo

Este relatório reflete a avaliação da empresa de Semi-condutores, a NVIDIA Corporation e está de acordo com o trabalho final de mestrado de Finanças do ISEG. Este relatório foi escrito com base nas recomendações do CFA Institute. A NVIDIA é uma empresa que está a enfrentar um momento bastante singular comparado com os seus competidores, com um crescimento anual de vendas de 40% e um aumento na avaliação das suas ações de 334,46% nos últimos dos anos. Não só a NVIDIA está a ter uma performance financeira interessante como se está a entrar em mercados emergentes como a autonomização automóvel e a criptomoeda, o que faz com que seja um caso de estudo bastante interessante. Também a fascinação em relação a tecnologia e em especifico, ao gaming, foram uma das razões pela qual esta empresa foi escolhida. Este relatório foi desenvolvido com base em informação pública disponível até 30 de Junho de 2018 e nenhuma informação posterior a esta data não foi considerada. O preço de ação de $303,67, foi obtido através do modelo de Fluxos de Caixa Descontados. O método de avaliação relativa foi tentado, porém dado à situação única da NVIDIA, não existe competidores que consideremos como peer's comparáveis em termos de múltiplos. Esta avaliação sugere uma recomendação de COMPRA, apesar do seu risco médio, dado que a NVDIA está consolidada no seu mercado principal, o gaming, porém existe alguma incerteza relativamente aos mercados da criptomoeda e autonomização automóvel.



Palavras-Chave: Equity Research; Avaliação; NVIDIA Corporation; Semiconductor; Placas Gráficas, Criptomoeda.

Classificação JEL: G10; G32; G34; G39

## Acknowledgements

The delivery of this report symbolizes the last point of this important stage of my life. It was 2 years of effort, devotion and dedication with highs and downs which ultimately culminate in this document.

In first place, to mother, Maria Natalia Oliveira Rodrigues, and my father, Timóteo Gameiro Manuel, which without then nothing of this was possible. They made an incredible effort, in these difficult times, to provide me with all tools necessary to complete this journey and it is for them that I worked every day, to make them proud and full of joy. Also to my two lovely sisters, Carla Gameiro and Ana Gameiro, which their advice were of must importance.

To my girlfriend, Adriana Vieira, which was there every day, in every struggle that with an enormous patience, heard me and advise me in the difficult times. Love you with all my heart!

To my all my friends, but specially to Daniel Frade, Filipe Marçal, João Dias, João Imaginário, Pedro Figueiredo, Ricardo Duarte, Sérgio Crispim and Tomé Reis. Due to their importance, I had to name them one by one. They were my men's of war that together made this 2 years and specially this hard summer without vacations, much more fun. I will take them in my heart.  FMU forever.

Finally, but with no less importance, to my supervisor, Rino Vieria, that gave me his pertinent comments and guidance in order to have the best report possible.

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# List of Abbreviations

| | |
|---|---|
| GPU | Graphic Processing Unit |
| P.V | Professional Visualization |
| OEM | Original Equipment Manufacturer |
| IP | Intellectual Property |
| FY | Fiscal Year |
| P2P | Peer to Peer |
| AI | Artificial Intelligence |
| CPU | Central Processing Unit |
| I&D | Investigation and Development |
| VR | Virtual Reality |
| NCGC | Nominating and Corporate Governance Committee |
| AC | Audit Committee |
| CC | Compensation Committee |
| CASS | Chinese Academy of Social Sciences |
| SoC | System on Chip |
| FAV | Fully Advanced Vehicles |
| ADAS | Advanced Driver Assistance Systems |
| ASIC | Application-Specific Integrated Circuits |
| FPGA | Field-Programmable Gate Array |
| IC | Integrated Circuits |

# NVIDIA CORP.

**BUY**

Medium risk

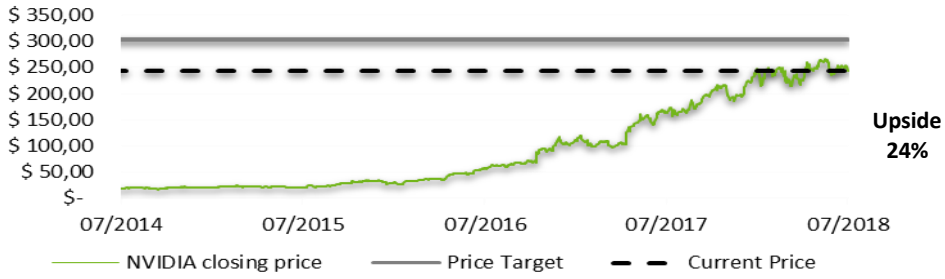
30 June 2018

United States of America

## Research Snapshot

NVIDIA valuation price is $246,46 at June 30, 2018. Using the Discounted Cash Flow (DCF) method, the price registered is $303,67, resulting in an upside potential of 24%. Considering NVIDIA stock as a medium risk investment, this give us a **BUY** recommendation.

**Figure 1: NVIDIA Historical Share Price**




Source: Bloomberg

**Table 1: Analyst's Risk Assessment**

| Low | Medium | High |
|---|---|---|

Source: Bloomberg

**Table 2: NVIDIA Market Data 30/06/2018**

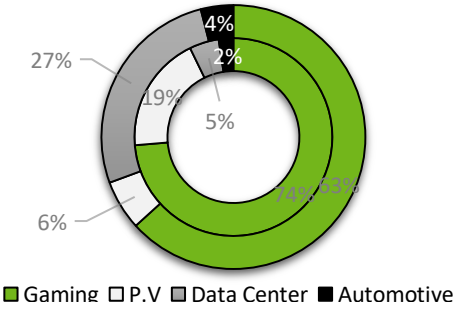
| Key Information | |
|---|---|
| Market Cap | 158,281B |
| Forward Dividend & Yield | 0,60 (0.23%) |
| Ex-Dividend Date | 2018-05-23 |
| Previous Close | 259,08 |
| Shares Outstanding | 607M |
| Day's Range | 255,01 - 262.00 |
| 52 Week Range | 157.37 - 269,20 |
| Avg Vol (3 month) | 9,22M |
| 1y Target Est | 295.67 |

Source: Yahoo Finance

**From a Gaming GPU supplier to a multimarket technology supplier**

In recent years, NVIDIA has been highly associated with a Graphic Processing Unit (GPU) gaming supplier only. In Fiscal Year (FY) 2014 NVIDIA had 73,7% of its revenue associated with gaming (considering gaming and Original Equipment Manufacturer (OEM) & Intellectual Property (IP), since almost 100% of OEM & IP revenue is gaming related). NVIDIA goal for the long-term is to diverse, even more, its main product (discrete GPU) to other markets, turning them essential to their optimal performance. In the analysis period, this trend is already being verified and expected but in a low scale, with an expected increase in data center (26,6% in FY2024) and automotive market share (4% in FY2024). Simultaneously, an expected decrease in gaming (63,3% in FY2024) and professional visualization market share (6,1% in FY 2024). There is an expectation that in a long-term (within ten to thirty years), this trend will be in higher proportion, with an equal market share between gaming, data center and automotive, due to lower margins, higher competitiveness and decrease of total market value of gaming, moving additional efforts for new markets, as fully autonomous automotive technology.

**Figure 2: NVIDIA Revenue by Segment as percentage of total revenue in FY2019 and FY2024**




Source: Yahoo Finance

**Cryptocurrency Mystery**

In a decentralized digital cash system network, every peer (user) needs to have a list with all transactions. But this generates the problem of every peer needs to be consensus about the records. Here is where the cryptocurrency enters. When someone requests a transaction, it is broadcast to a peer to peer (P2P) computer network. After its confirmation, the operation or "block" is set on a historical transaction called "chain" This system is operated through what is called by miners which are rewarded with a token of the cryptocurrency. To prevent misconduct of miners, they need to solve a mathematical puzzle known as Proof-of-work. All network miners compete to solve this problem and when someone finds the solution, it announces in the network and receives the token and then there is the creation of one block. Finally, the resolution of this problem requires the enormous amount of computer power, and since there is a competition of who solves first, the more power the best. This created and incentive to miner to get the most powerful GPU on the market. Is expected that NVIDIA explores this market in the future, although with cautious, being this market one of the most volatiles in existence and with no certain future.

**Figure 3: Bitcoin Value ($)**


Source: Yahoo Finance

# Business Description

### Short History

NVIDIA Corporation it is a company created in 1993 founded by Jensen Huang, Chris Malachowsky and Curtis Priem, through the necessity of solving complex problems in computer science. They started by focusing on PC graphics, and extended their market, following the digital revolution, to the Artificial Intelligence.

In 1995 they launched their first product, the NV1, which was used to create final products by SEGA, the arcade game leader at that time. In 1999, NVIDIA introduced the GPU, with two new products, the GeForce and Tesla. Seven years later, after selling over five hundred million graphic processors, the company launched Tesla GPU for super computers. One year after, they extend their market to Tegra processors with the launch of GRID in 2012. With the evolution in TV experience, NVIDIA launched SHIELD in 2015.

NVIDIA Corporation is a company that operates through GPU and Tegra Processor. Based in these two hardware components, NVIDIA created products that address four markets: Gaming, Professional Visualization, Datacenter, and Automotive.

The GPU business include GeForce for PC gaming; Quadro for design professionals that focus on video editing and special effects; Tesla for Artificial Intelligence (AI) utilizing deep learning for general purpose computing; GRID for cloud and datacenter.

The Tegra processor are primarily design for automotive self-driving capabilities, which comes in Drive PX platform and for mobile-cloud with SHIELD.

### NVIDIA operational segments

***GeForce***

GeForce is a brand of (GPUs), with the purpose of enhance gaming experience by improving the visual quality of graphics and realism across all gaming experience.

***Quadro***

Quadro is a graphics brand created by NVDIA specialized to serve the needs of the professional visualization (P.V) market. With specialized components Quadro offer the clients the best performance for creation of images and animations.

***Tesla***

The Tesla products target the high-performance computing market with a very high computational power. Tesla products are primarily used: in simulations and in large scale calculations; for high-end image generation for applications in professional and scientific fields. Data scientists and researchers can now parse petabytes of data orders of magnitude faster than they could using traditional Central Processing Unit (CPU), in applications ranging from energy exploration to deep learning.

***Drive PX***

The Nvidia Drive PX is a series of computers aimed at providing autonomous car and driver assistance functionality powered by deep learning. The NVIDIA DRIVE platform combines deep learning, sensor fusion, and surround vision to change the driving experience. It is capable of understanding in real-time what's happening around the vehicle, precisely locating itself on an HD map, and planning a safe path forward.

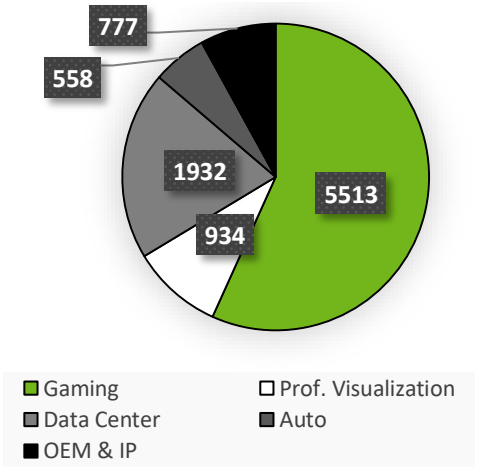
***SHIELD***

Is a set-top box that that generally contains a TV-tuner input and displays output to a television set and an external source of signal, turning the source signal into content in a form that then be displayed on the television screen or other display device. Emphasizes its ability to play downloaded games and stream games from a compatible PC on a local network, or via the GeForce Now subscription service. As with all other Android TV devices, it can also stream content from various sources using apps, and also supports 4K resolution video.

**Figure 4: NVIDIA GPU Architecture Roadmaps**

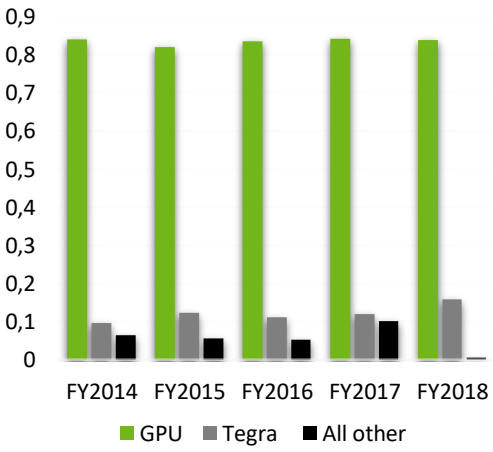

Source: NVIDA's GTC 2017 Conference

**Figure 5: NVIDIA FY 2018 Revenue by Markets (in $ millions)**




Source: NVIDA Quarterly Revenue Trend 2018

**Figure 6: NVIDIA Revenue by Reportable Segment (% of total revenue)**




Source: NVIDA Financial Report

**NVIDIA geographic market share**

NVIDIA books revenue based on the location of its board partners, not on the location that the actual end-product is sold. Considering this, 30,8% of NVIDIA revenue in FY2018 is from Taiwan, where the main board partners are located, like ASUS, Gigabyte and MSI. Other Asia Pacific represents 19.5%, followed by China with 21.3% of total sales. United States have a 13.1% market share, in front of Europe and other Americas with 7.9% and 7.4%, respectively.

**Company key drivers of profitability**

In FY2017 NVIDIA sold 5,822 billion dollars in GPUs, which represents 84,2% of total revenue. Regarding the Tegra processor segment, there was 824 million dollars in revenue, representing 11,9% of total sales. The residual is composed by patent cross licensing with Intel, which is 264 million dollars. Comparing with FY2016, there was an increase of 39% in total revenue, 39% in GPU and 48% in Tegra processors sales.

Being NVIDIA a technological company, innovation is one of its pillars, spending over $13 billion in research and development. Research and development as a percentage of net revenue decreased in the last three years (8,8% since FY2015), driven by an increase in sales offsetted by a non-proportional growth in employees and related costs that rose Investigation and Development (I&D) expenses in FY2017.

Concerning the gross margin, there was an increase in FY2015, FY2016 and FY2017 with 55,5%, 56,1% and 58,8%, respectively. The main reasons for this growth are the higher mix of NVIDIA GPU business, fewer inventory provisions, and lower warranty charges in the Tegra Processor business.

**Company strategies**

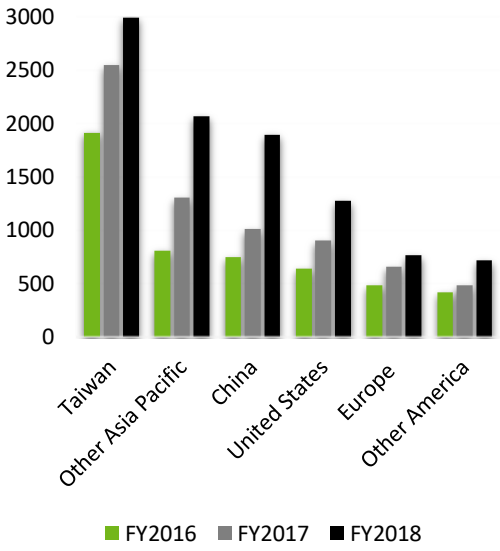
Extending technology leadership in AI – With the evolution of technology, the use of AI and specifically deep learning in computer science is almost required. One of NVIDIA goals is to improve AI-specific features to its GPU Architecture, so that any server, cloud or super computer has one of the NVIDIA platforms. This can be achieved through partnerships with universities and other companies.

Revolutionizing computing with the GPU's parallel processing capability – With the capacity of NVIDIA GPU processors over the CPU, NVIDIA wants to revolutionize its platforms with a continuous improvement of the parallel processing capability, overcoming Moore's Law, so it can be used in areas like, financial risk analysis and big-data analytics.

Extending NVIDIA technology leadership in visual computing – With a consistent leadership in the PC Gaming GPU market, NVIDIA believe in a future dominance of the visual computing segment. Using its knowledge on GPU, NVIDIA can enhance user experience in very high growth markets like cinematic production and new hot markets, such as, Virtual Reality (VR).

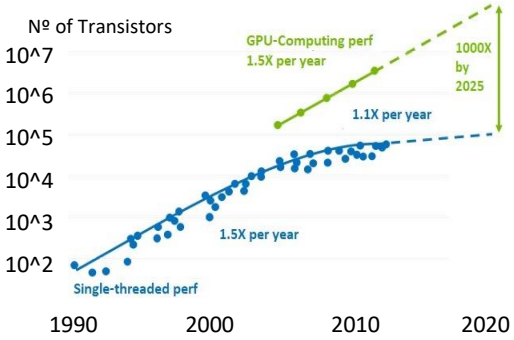
Licensing NVIDIA intellectual property – NVIDIA have revenue coming from product sales and from license and development. To increase the revenue from license and development, the company needs to license its intellectual property that will be accessed by customers and partners.

**Figure 7: NVIDIA Revenue by Geographic Region (in $ millions)**




Source: NVIDA Financial Report

**Figure 8: CPU performance vs NVIDIA GPU performance**




Source: NVIDA GTC 2018

# Management and Corporate Governance

Following the requirements of NASDAQ, the Corporate Governance Policies require NVIDIA Board to be independent not allowing that the decisions taken by the board being interfere by relationship that jeopardizes their judgment. Thus, 92% of the members of the Board are independent.

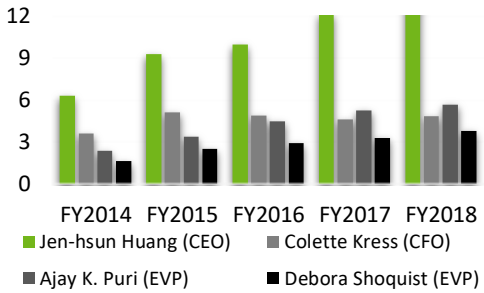
The Board of directors has three standing committees: NCGC (Nominating and Corporate Governance Committee), AC (Audit Committee) and CC (Compensation Committee). As principal responsibility, the Board must insure the best interests of stockholders, through company´s decisions management. Other Board responsibility, with the assistance of the NCGC, is the election of new directors each year, which also are nominated by stockholders. The Board and the NCGC, based in experience and the candidate's skills that the board needs, elect new directors. The re-election of director will be recommended, according the participation and contribution of past meetings. In this case, the NCGC have to considerer any relationship between the candidates and stockholders, to ensure the candidates independency. The AC, selected by the Board, is responsible for overseeing the quality and integrity of the financial statements. The composition of this committee shall meet the requirements by NASDAQ, in terms of independence and experience. Complying these requirements, the AC shall be composed by, at least, three directors nominated by the Board. The NVIDIA NCGC, has as principal purpose, the performance evaluation of current directors and committees, and prospection of new directors. This committee is comprised by at least two independent members of the board. The NVIDIA CC is responsible, based on the company's compensation plans and structure, to review and approve the compensation of board members, and also, to assess and monitor the potential of the compensation policies to lead to excessive risk-taking behavior. The CC shall be constituted by three directors and, similarly to the AC and the NCGC, this committee must meet the requirements by NASDAQ, in terms of independence and experience.

According to the bylaws of NVIDIA, there is an allowance to nominate a chairperson of the Board. NVIDIA believing that all members of the Board are equal, they decided, that instead of having a chairperson, a Lead Independent Director shall be nominated by the majority vote of the independent directors. This position is occupied by William Miller since 2009, an independent consultant, with a vast experience in corporate governance. He was chief executive officer and chairman of companies like Avid Technology, Inc and Quantum Corp. As Lead Independent Director, Mr. Miller is responsible for schedule of Board meetings, working with the CEO to ensure the quality and integrity of the information by the Board and serving as connection between the Board and the director.

**Shareholder structure**

Mainly institutional investors, following an Anglo-Saxon Model, own NVIDIA. However, it can expose the company to certain risks. These investors are normally pension funds, hedge funds, insurance companies or banks that have as purpose the mitigation of risks. Thus, they are not interested in the corporate governance of a particular company. Instead, they are looking for short-term returns. This can lead to pressures, by activist shareholders to the board, in order to convince certain members to change company's policies, to suit their personal interests, instead of following company's long-term interests. There are many ways that investors can do so, for example, through say on pay votes or influence in director elections. Although, NVIDIA presents a suitable Governance structure, with the assistance of the committees have strong supervision through the board director's independency.

**Figure 9: Nvidia Key Executive Compensation (in $ millions)**



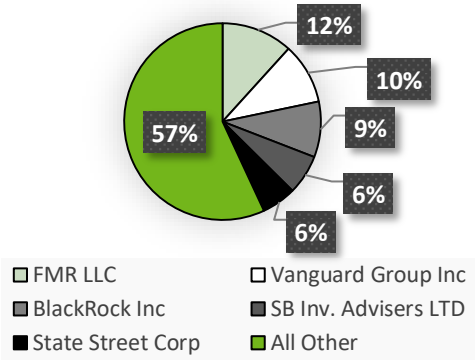

Source: NVIDA Financial Report

**Table 3: Board Constitution**

| Name | Committe |
|---|---|
| Jen-Hsun Huang | CEO |
| James Gaither | NCGC |
| Rob Burgess | CC |
| Tech Coxe | CC |
| Persis Drell | CC |
| Dawn Hudson | AC |
| Harvey Jones | CC, NCGC |
| Michael McCaffery | AC |
| Mark Perry | AC, NCGC |
| Brooke Seawell | CC |
| Mark Stevens | AC, NCGC |

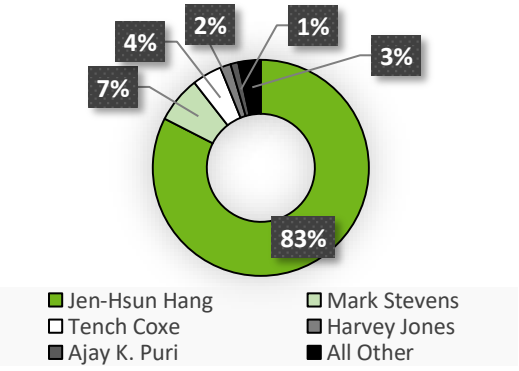
Source: NVIDA Financial Report

**Figure 10: Top 5 of Institutional Holdings**




Source: Nasdaq

**Figure 11: Top 5 Inside Holders**




Source: SEC Fillings 2018

# Industry Overview and Competitive Positioning

## *Economy outlook*

### Global Economy outlook

The Global economy is facing a positive recovery supported by an increase in investment, manufacturing activity and trade. According to the World Bank, GDP will grow expectedly 3 percent in 2018, increasing 0.6 pp comparing to the previous year. Although is expected a deceleration in the next years. This expectation is motivated by substantial downside risks, increased protectionism and geopolitical tensions.

### USA economic outlook

After the construction of the new headquarters, NVIDIA will pay a rent in the form of interests, which is based on variable interest rates and consequently affected by US market interest rates. USA had positive GDP annual growth, what helps to explain and is also explained by the decrease in the unemployment rate of 4.1%, reaching a minimum low in more than 10 years, as well as by a strong private sector confidence. OECD expects that strong business and consumer confidences will support consumption and investment growth in 2018 and 2019. Furthermore, expects a slow employment growth that will be partly offset by wage growth acceleration.

### Trump Effect

One of the policies of the Donald Trump's economic plan is the cut of income taxes and reduction of corporate tax rate. The Trump Administration is imposing protectionism measures, such as tariffs on steel and aluminum imports, tariffs to specifically geographic places as China, South Korea and the withdraw from the Trans-Pacific agreement which has countries as Canada, Mexico, Australia and Singapore. Ultimately, this can lead to a trade war that can have long-term consequences as the raise of prices, cost jobs, slower economic growth and a possible obligation of transferring the production to US. This would have a major impact in NVIDIA financial results since the semi-conductor industry is characterized by high start-up costs and significant investments. To have the necessary funds to build a plant, NVIDIA faces the risk of having to redirect their funds from I&D and possibly losing competitive advantages.

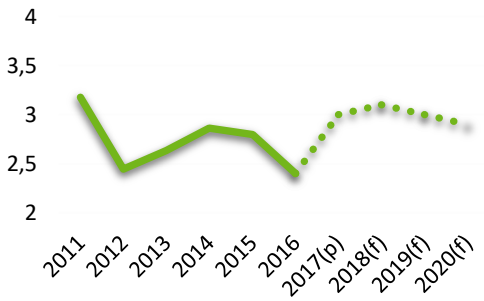
### Taiwan Economy Outlook

In recent years, Taiwan had high GDP growth variations, due to the unstable economy performance of China. With an economy supported mostly by exports, a reduction of imports from China or North Korea, would have a huge impact on Taiwan economy. In the future, the emergence of the semiconductor industry will support a slight increase in Taiwan exports and consequently in Taiwan GDP growth. Being Taiwan one of the largest chip manufactures in the world, this economy faces several risks, starting with the dependency of China economy, to where a third of the total exports goes. In a long-term perspective, according to a report done by (Kalish, 2017), the working-age of the population is increasing, which can lead to a lower productivity and economic growth.

### China Economy Outlook

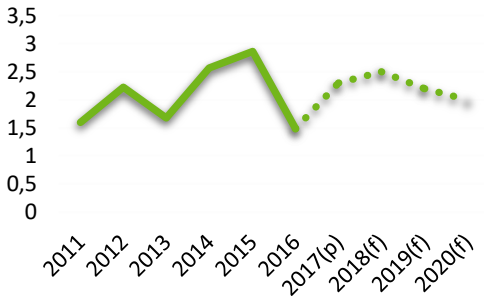
In the near future, is expected that China's economy slows down. The war trade with US will lead to the growth of domestic debt and to the decrease of exports. In a long-term perspective, China faces some issues, as the well know demographic problem and unemployment. According to (Sciences, 2016) the one-child policy that was implemented to reduce birth rate backfires with a rapidly aging population, that can bring lower productivity growth and older population. CASS also reported that technology industries had grown in an exponential level, requiring more creation of jobs, offsetting the rise in unemployment on more traditional industries like steelmaking.

**Figure 12: World Real GDP Growth**



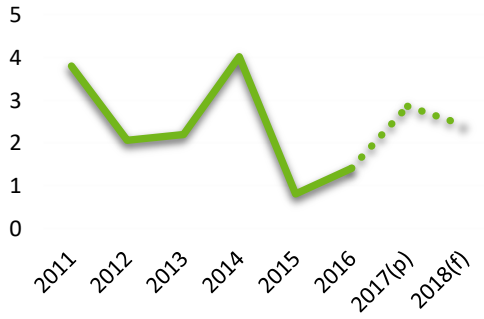

Source: World Bank

**Figure 14: US Real GDP Growth**



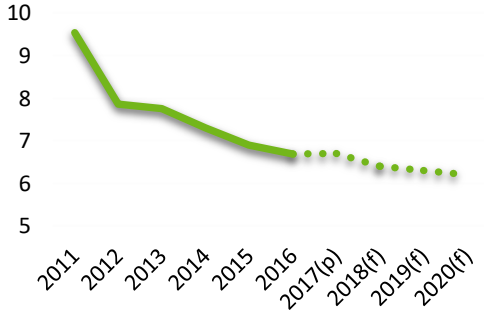

Source: World Bank

**Figure 13: Taiwan GDP Growth**




Source: National Statistics Republic of China (Taiwan)

**Figure 15: China Real GDP Growth**




Source: World Bank

## *Demand Analysis*

### Gaming

Regarding the PC gaming industry, the main buyers are OEM that incorporates NVIDIA products in their own final products, like Asus, which is the main costumer with 12 percent of total revenue of the company for fiscal year of 2018. The PC industry can be divided into two different markets. We have the PC market for general purpose and PC market for gaming. While traditional PC market faced some struggles, due to the increase of powerful mobile devices, gaming pc hardware are on the rise. According to GFK, in the first half of 2017, there was an increase of 55% in desktop gaming pc sales and an increase of 24% in gaming notebooks, due mainly to competitive gaming, or in other words, eSports. According to Statista, eSports had a revenue growth of 162%, which is expected to increase even more until 2021 with a forecast revenue of 1.65$ billion, representing a 254% growth. eSports is the world fastest growing sport in terms of number of spectators, with 385 million ones in 2017, providing semi-conductor companies a great marketing platform that can influence the overall demand for their gaming products.

Due to high growth of technologically advanced electronics consumption, the System on Chip (SoC) market had been in a rising. According to the Transparency Market Research this market will grow at an 8.4% CAGR from a market that in 2016 had a value of 45,89$ billion.

### Professional Visualization

With the increase of next generation technologies, such as, VR and AR, allowed the extension of different types of costumers, consequently, increasing the demand for visual computing technology that enhances the image and video processing in industries like healthcare, entertainment and automotive. These technologies will act as a factor driving in visual computing growth in the next years. Although, the range of costumers is much smaller than the gaming market since visual computer requires very skilled labor and the installation costs of workstation are very high, which restraints the future growth of this market.

According to a research report (MarketandMarkets, 2015), “The total visual computing market is expected to grow from USD 4.19 Billion in 2013 to USD 22.02 Billion by 2020 at a CAGR of 22.59% between 2015 and 2020”

### Data Center

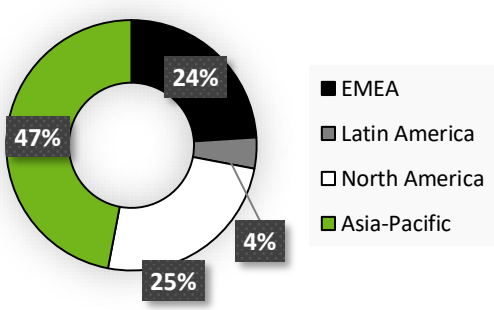
Companies such as HP, Dell and Cisco, use specific GPUs for deep learning in their standard servers. It is also used for cloud services and in companies like Facebook, Amazon Web Services, Ali Cloud, Azure that also use DGX AI supercomputers for AI accelerated analytics, fraud and internet security threats detection. According to the seventh report “Cisco Global Cloud Index (2016-2021)” by Cisco, is expected that the global data center cloud traffic will reach 19.5 zettabytes until 2021. This correspond to an increase of 117% compared to 2016. The main reasons for this rise are the growth of social networks, video streaming and business applications.

### Automotive

Being car technology increasingly, automakers are looking for incorporate those technologies in their cars. GPU producers are collaborating with car automakers for the supply of platforms to run automotive software systems. These partnerships do not only have as purpose selling such products, but also to collaborate in investigation and future business on self-driving cars, as the partnerships with UBER.

The self-driving market is a very recent market that is still in development but with a huge potential. According to (McKinsey&Company, 2016), foresees that 50 percent of passenger vehicles sold in 2030 will be highly autonomous and 15 percent fully autonomous. Although, this market is facing several challenges, such as constrained

**Figure 16: Global Games Geographic Market shares in 2016**




Source: Newzoo

**Figure 17: Top Use Case of P.V based on 5 Year CAGR (2016-2021**

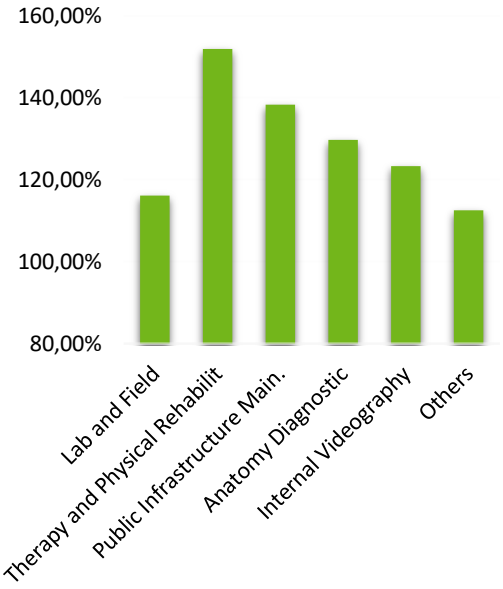
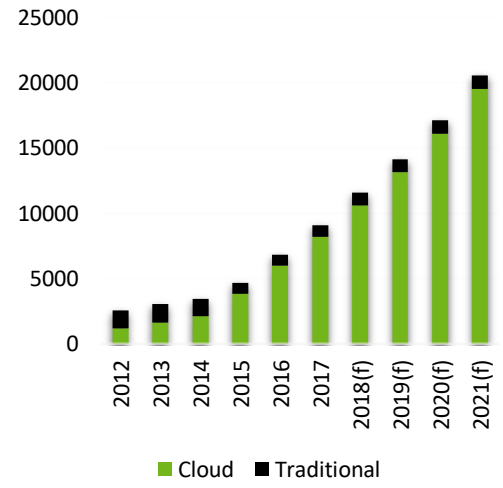



**Figure 18: Global Data center IP traffic (in exabytes)**




Source: Cisco Systems

market penetration, regulation laws, consumer understanding and acceptance and safety/security issues. While we can see the Fully Autonomous Vehicles (FAV) as the end of road, Advanced Driver Assistance Systems (ADAS) is an intermediate level of automation that is growing at a fast pace. According to Allied Market Research, ADAS global market was valued as 25.116$ million in 2016 and is expected to grow at a CAGR of 21,2% until 2025 with a value of 143.051$ million.

## *Supply Analysis Outlook*

NVIDIA do not manufacture, assemble, test and/or pack its products, instead it utilizes what is known as fabless manufacturing strategy, which means that the company depends on third parties and their technology to manufacture, assemble, test and/or package the products. One of the main components of the GPU is the silicon wafer that is produced by Taiwan Semiconductor Manufacturing Company Limited (TSMC) and Samsung Electronics Co. Ltd. Due to high growth demand of GPUs, both companies are struggling to keep up the production which is slowing NVIDIA shipments. One of the major consequences of this demand is the rise of silicon. CEO of SUMCO, the main TSMC supplier of raw wafer material and responsible for over 60 percent of the world's silicon wafer supply, confirmed that they plan to raise the price of silicon wafer by 20% this year (2018) and again in 2019. Thus, there is a high expectation for an increase in manufacturing costs that will lead to higher GPU's prices.

## *Demand vs Supply equilibrium breaker: Cryptocurrency*

There is another market that are increasing GPU demand, and that is Cryptocurrency. Crypto mining requires an enormous amount of computer power, which created an incentive to miners to get the most powerful GPU on the market. In 2017, price of bitcoins rose 1.300% which lead miners to buy all GPUs from NVIDIA and AMD with a special interest to the gaming GPU, breaking all inventory of both companies. Seeing this apparently correlation, investors are betting in cryptocurrency through NVIDIA and AMD stocks. The future of this market is unknown, with very diverse opinions, but in case of a bright future, it can be one of the biggest sources of NVIDIA revenue in the future. More information related to the correlation between NVIDIA stock and Cryptocurrencies prices in Appendix 19.

## *Competitive Position*

### Porter's 5 Forces

Porter's 5 forces help to understand the strength of an organization's current competitive position through the analysis of competitive intensity and attractiveness in terms of profitability.

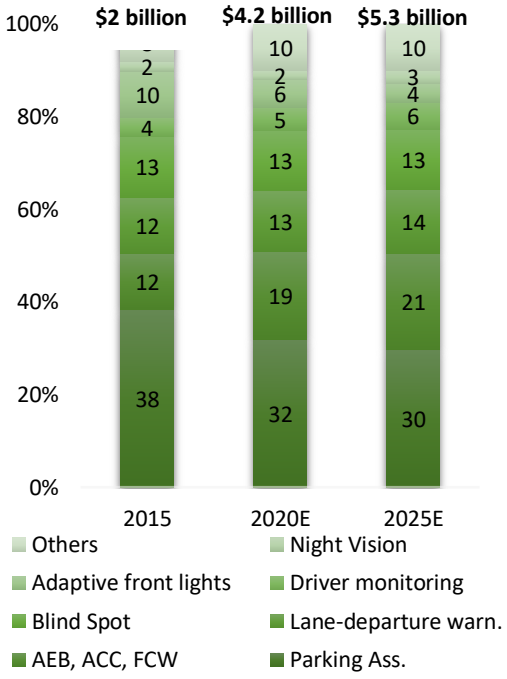
### Threats of New Entrants (ToNE) – Medium-Low

As was mention before, the GPU market, from gaming to AI deep learning, is a billion dollars market with tremendous growth rates. This can incentive new competitors in the market. Although this is a market with two massive players, with high level of ID and experience which represents some serious constraints to new companies to emerge. NVIDIA alone has more than 2300 patents. In the SHIELD market, there is strong competition, like Apple and Amazon, which discourage new entrants. Regarding the autonomous cars, this is a market that is still developing, but with high potential. Being so, chipmakers like Qualcomm, Intel and AMD are expected to enter in this market in the next years, turning it in a highly competitive.

### Bargaining Power of Suppliers (BPoS) – High

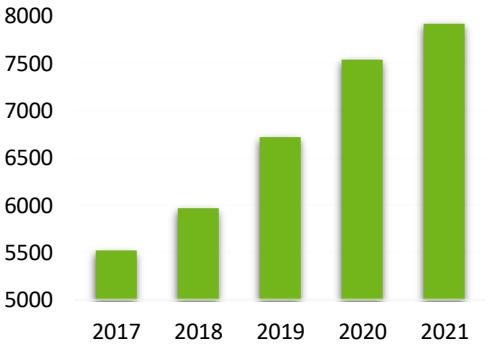
NVIDIA use industry-leading suppliers that are certified by the International Organization for Standardization, which comes with a price. Being industry-leading, gives them power to bargaining, as it happens with Taiwan's TSMC one of the principal NVIDIA suppliers and the biggest player in its market. With the lowest production cost and the biggest clients, such as Apple, the pressure of NVIDIA looking for another

**Figure 19: Semiconductor revenue in ADAS per app (% of ADAS total revenue)**



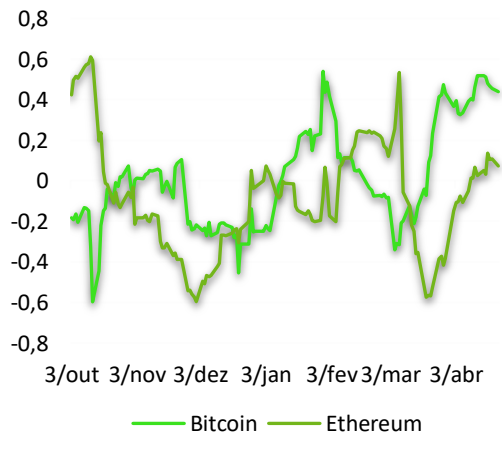

Source: McKinsey&Company

**Figure 20: Demand forecast of 300mm silicon waffer (in $ millions)**




Source: SUMCO estimations

**Figure 21: Correlation between NVIDIA stock and Cryptocurrencies prices (2017-2018)**




Source: Nasdaq and Author Calculations

wafer supplier is low, which gives TSMC a high bargaining power. Such high power from Suppliers, can decrease NVIDIA margin with the increase of revenue cost.

**Bargaining Power of Buyers (BPoB) – Medium-High**

As being already mentioned, there is a significant amount of revenue from a limited number of customers, which give them the power to seek increasing discounts and offers. Also, with an intensive competition there is an empowerment of the buyers. In reverse, NVIDIA has a strong equity brand between final consumers, which attenuates this bargaining Power.

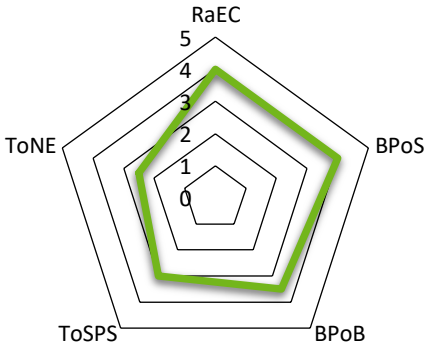
**Threats of Substitute Products or Services (ToSPS) – Medium**

Considering the GPU and P.V, AMD have a series of products called Rayzen and Vegas, respectively. This GPU's can substitute NVIDIA GTX and Quadro, although they are far behind in terms of performance. To have equal performance comparing one NVIDIA card and one AMD card, the AMD would be much more expensive. Regarding the AI datacenter, there are other accelerators than GPU's hitting the market, like ASIC's (application-specific integrated circuits) and FPGAs (field-programmable gate arrays) supplied by companies like Broadcom and Marvell Technology. ASIC' has the advantage of being customized to specific function that better performances GPU. With this new technology some crypto miners started to substitute GPU for ASIC. FPGA (Field Programmable Gate Array) is also a type of Integrated Circuit, but it does not have the programming built into it during the production. As the name implies, the Integrated Circuits (IC) can be programmed by the user as long as he has the right tools and proper knowledge. Although, NVIDIA with the CUDA programing gives them advantage, making easier to use GPU than ASIC or FPGA. Detailed information about GPU vs FPGA performance in Appendix 20.

**Rivalry among the Existing Competitors (RaEC) – High**

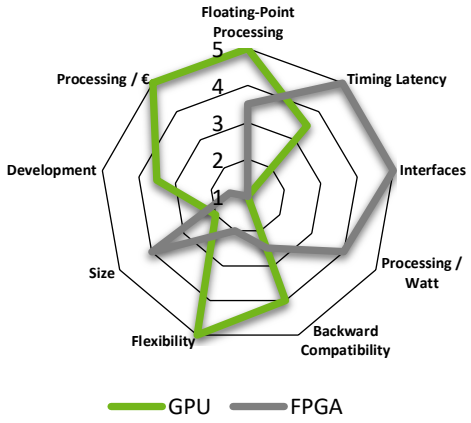
For NVIDIA, competitors are the companies that sell discrete and integrated GPUs and accelerated computing processing solutions, such as Advanced Micro Devices, or AMD, ARM Holdings plc, Imagination Technologies Group plc, Intel Corporation, or Intel, and Xilinx, Inc. In the market of System of Chip supply, which are incorporated in final products such as Smart TVs, Set-top-boxes, gaming devices and monitors, the competitors are companies like Ambarella, Inc., AMD, Apple, Inc., Broadcom Ltd., Intel, Mobileye N.V., Qualcomm Incorporated, Renesas Electronics Corporation, Samsung, and Texas Instruments Incorporated. Within the gaming GPU and professional visualization business, the competition is intense, with AMD increasing his market share with products focused in price/performance and Intel trying to enter in the market. Regarding the data center AI products, given the strong opportunities, the competitiveness is increasing in fast pace. Intel is one of the biggest investors related to AI, with the creation of Xeon Phi that is competing with NVIDIA's Tesla GPU. AMD is partnering with major Chinese companies like FXI, to combine efforts in the development of Artificial Intelligence. The rivalry in the automotive market can be divided into two types. The competitors that supply ADAS technologies, like Qualcomm, Texas and Intel. More than ever automakers want cars to be better performers and that takes electronics. Thus, chipmakers are taking part of that goal, which make this part of the market highly competitive. Regarding the autonomous vehicles is currently moderate or even low. Nevertheless, to the extent that companies are investing in AI, they are using that efforts to enter in this market. Intel, after acquiring Mobileye is working with BMW to bring driverless cars to the market. Google with a company named Alphabet Inc had registered a patent with a technology that have rapid automated reactions. Considering this, autonomous vehicles will be a highly competitive market in the future.

**Figure 22: Porter's 5 Forces**



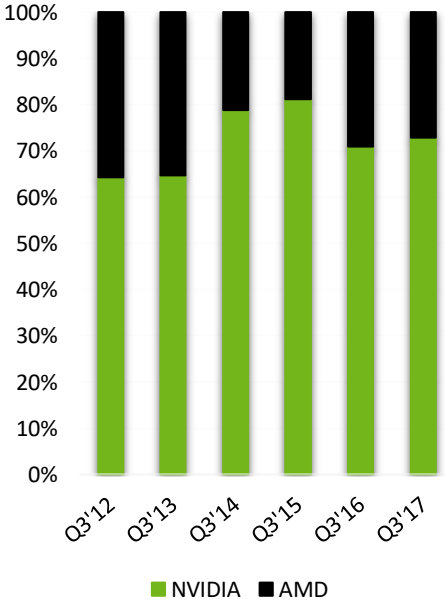

Source: Author, Company Data

**Figure 23: GPU vs FPGA performance**




Source: Berten Digital Signal Processing Whitepaper

**Figure 24: Global discrete GPU Shipments market share**




Source: Jon Peddie Research

## *SWOT Analysis*

For the understanding of NVDIA's organizational strategies and its businesses position relatively to peers, it is essential to examine NVIDIA Strengths, Weaknesses, Opportunities and Threats

**Strengths**

Product Mix: Based in a group of architectures and with the same inputs, NVIDIA has the capacity of targeting different markets.

Brand Equity: NVIDIA is known for delivering the most powerful, efficient and innovative products in their markets, which created a group of loyal customers.

Investigation & Development: High investment levels in I&D, allows NVIDIA to be always ahead of its competitors and to create constraints to new entrants.

Patent Registration: NVIDIA has more than 2.300 patents registered, which constraints its competitors to use NVIDIA innovations in their own products.

**Weaknesses**

SHIELD Market: NVIDIA is far away from its competitor in terms of sales in this niche. Being the Shield a product in the set-top box market directed to gamers, this segment have very low client target.

Concentration of Revenue: NVIDIA has a small number of customers representing the majority of NVIDIA revenues, which makes the company very dependent on the performance of these few customers.

Fabless Manufacturing: With third parties being responsible for the production, NVIDIA loses control over the quality, quantity and the ability to meet customer demand of their products.

Revenue seasonality: NVIDIA have typically seen stronger revenue in the second half of fiscal year driven by the majority of NVIDIA revenue coming from the consumer industry.

**Opportunities**

New Products: In the Tech business there is considerable space for more innovation and new products.

Cryptocurrency: With the boom of virtual money and specific the use of the block-chain system, this can be a new market that NVIDIA can explore with a huge revenue potential.

Autonomous vehicles: Is expected that driverless cars will be the future of the billionaire automotive industry. This is a huge opportunity for NVIDIA.

**Threats**

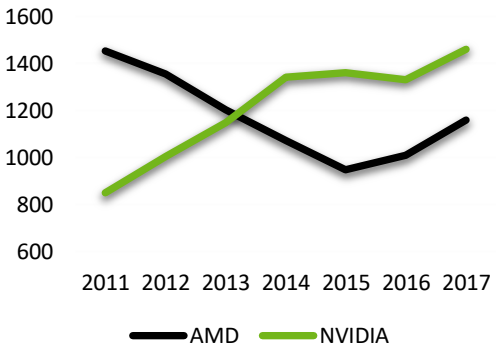
Competition: Being NVIDIA in strong growth markets, there is always incentives for other major companies to entry in the market, or for creation of alliances between competitors.

Partnerships among competitors: With a high concentration of market share between a small number of competitors, a partnership between them can be a threat to NVIDIA market share.

Cryptocurrency: Not only a big opportunity, but also a big risk. Being the cryptocurrency one of the most volatile markets, the fail of this market can jeopardize NVIDIA revenue in the present as well as in the future.

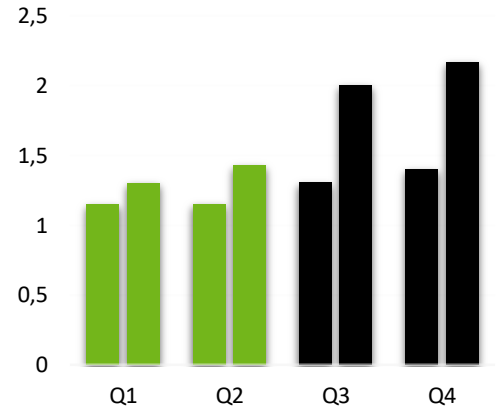
Economic slowdown and financial fluctuations: With the world economy still recovering from the 2008 crisis, this recovering cycle with a very speculative future can be short, which can lead to financial fluctuations.

**Figure 25: Research and Development (in $ millions)**



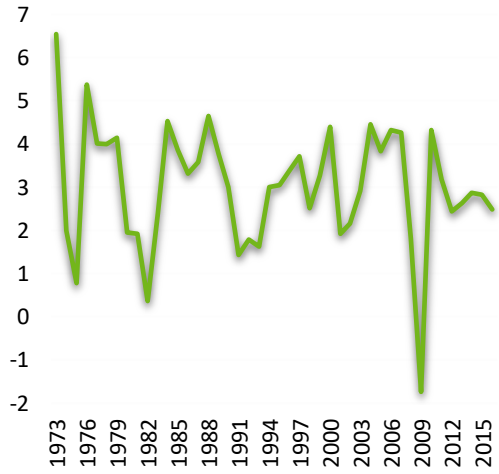

Source: Financial Reports

**Figure 26: Revenue Seasonality in $ billions (2016-2017)**




Source: Financial Reports

**Figure 27: World GDP Growth (annual %)**




Source: World Bank

# Investment Risk: Description

**Innovation Risk – Identification of new products (Impact – High; Probability – Medium)**

Being NVIDIA a Tech company, innovation is a key issue. With NVIDIA investing over $4 billion over the last three years, which is more than the $3 billion of the main competitor AMD. This decrease the probability of NVIDIA being overtaken by a competitor. Not only is important to have innovated products but also identifying changing needs and emerging technology trends. Based in NVIDIA history, the company did it very successfully. Nevertheless, there is a possibility for new start-ups to appear, with different technologies, which will jeopardize its revenue and its financial results.

**Operational Risk 1 – Manufacturing yield (Impact – High; Probability – Medium)**

When NVIDIA designs a product, they do not know if there will be a yield problem or not, that is, if the ratio of good chips to the total chips produced from a given silicon wafer will be low. Having NVIDIA products very complex designs the probability of low yields increases. With NVIDIA practicing a fabless production, they have limited access to wafer foundry capacity, which could result in higher manufacturing costs and deterioration of costumer or partner relationship. Historically there was yield problems in 2003 and 2010, but nothing in the recent past.

**Operational Risk 2 – Cyber-attacks (Impact – Medium; Probability – Medium)**

According to a report done by (Internet Society , 2018), business cyberattacks almost doubled in 2017 compared to 2016. NVIDIA was victim of one cyberattack in 2014 that lead to a customer service website shutdown for two weeks for investigation, but without further consequences. A more serious attack can have a very high impact on the company. With more than 2.300 patents registered and high successful products, competitors can misappropriate NVIDIA confidential information. Information about NVIDIA, their partners or customers that will result in a loss of reputation and possible cessation of service. To prevent this, NVIDIA invested in a cybersecurity startup deep instinct company that have 99 percent detection rates, compared with about 80 percent detection from conventional cybersecurity software. Its software can automatically detect and defeat the most advanced cyberattacks.

**Operational Risk 3 – Fabless Manufacturing (Impact – High; Probability – Medium)**

Since NVIDIA is not responsible for the manufacture, assemble, test or package, the company loses control over the product quality and quantity, development and product delivery schedule. NVIDIA also rely in third-party for the software tool supply that helps in the design and verification of new products, which had problems in the past that leaded to a delay in the introduction of new products. This delay can result in design cycles misses, which could lead to loss of market share and decline in revenues.

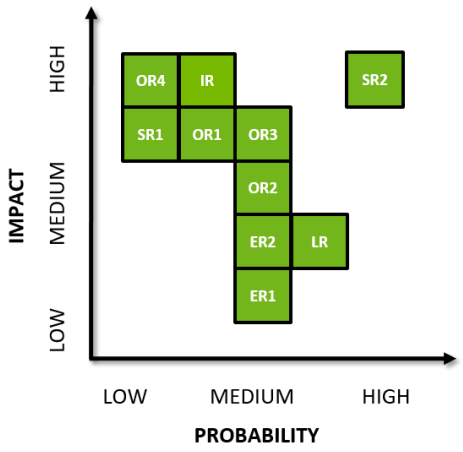
**Operational Risk 4 – Business disruptions by natural disasters (Impact – High; Probability – Low)**

The manufacturers responsible by NVIDIA production, are located in an area highly subject to natural disasters. With frequent floods and close to a major earthquake fault, a business disruption is a major risk to have into account. Not only in the production, but also in NVIDIA headquarters and portion of theirs research are located in California, a region known for high temperatures, water shortage and fires.

**Strategy Risk 1 – Low Number of Customers (Impact – High; Probability – Low)**

One of the main risks for NVIDIA is the concentration of revenue in a low number of costumers, considering those with 10% or more of NVIDIA total revenue. If one of these costumers decide to decrease the numbers of orders or not to incorporate one of NVIDIA's hardware in their own products, it can have a major impact on their results. Although, with NVIDIA brand equity and loyal customers, the probability of not incorporating NVIDIA products is low.

**Figure 28: Risk Matrix**



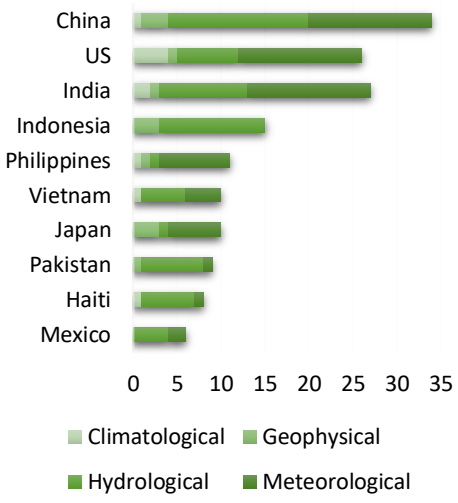

Source: Author

**Table 4: 10 of the Biggest Corporate Hacks in History**

| Company | Year |
|---|---|
| LinkedIn | 2012 |
| Target | 2013 |
| JPMorgan | 2014 |
| Home Depot | 2014 |
| Sony | 2014 |
| Hilton Hotels | 2015 |
| Cravath Swaine & Moore | 2015 |
| Swift | 2016 |
| Tesco | 2016 |
| Chipotle | 2017 |

Source: Fortune

**Figure 29: Top 10 countries by number of reported events in 2016**




Source: Annual Disaster Statistical Review 2016

**Strategy Risk 2 – Cryptocurrency (Impact – High; Probability – High)**

With the boom of cryptocurrency, the demand for NVIDIA GPU increased, leading to an inventory depletion, with a considerable high number of GPUs being use for crypto mining. One of the problems of crypto miners compared with gamers is that miners have no loyalty, meaning that at each moment, they choose the most powerful GPU, regardless of the manufacturer, to crack the problem, which is very lucrative to them. In addition, if the cryptocurrency crushes, the crypto mining would become less lucrative and miners would start to sell their cards on the secondary market for a much lower price, affecting NVIDIA sales. One of NVIDIA strategies to fight this trend is to restrain retail partners to limit orders to two cards per person and a creation of a specific GPU for crypto mining. Although since investor are capitalizing their money into cryptocurrency through NVIDIA stocks, an impact in virtual currency value can have a high impact in NVIDIA stock value.

**Economic Risk 1 – Investment and Interest Rate Risk (Impact – Low; Probability – Medium)**

A variation of interest rates could lead to an impact in NVIDIA investment portfolio and in their results. This portfolio is composed by fixed and floating rate investments, which means that if interest rates increase, the market value of fixed rate securities could decline and if interest rates decrease, the floating securities could provide less income than expected. Considering only debt securities, they are classified as "available-for-sale", which mean that changes in interest rate will not affect NVIDIA's Consolidated Statements of Income, only if they are sold prior the maturity. Almost all investments done by NVIDIA have a rate of A/A3, which reduce the rate variation impact.

Also, the financing of the new headquarters is based in an off-balance sheet, built-to-suit operation lease arrangement. This arrangement consists in a loan of 380$ million relating to construction costs. Once the construction is complete, NVIDIA will pay a rent in form of floating interest rate that NVIDIA hedged with an interest rate swap to mitigate this risk. In January 28, 2018, NVIDIA preformed a sensitivity analysis regarding fix and floating rate investments that states that with a parallel shift in the yield curve of both plus or minus 0,5%, would result in fair value changes of 14$ million. Also, if the fair value of the investment in government agencies and in the financial sector drop 2% to 5%, it would generate a decline in fair value between $73 million and $184 million.

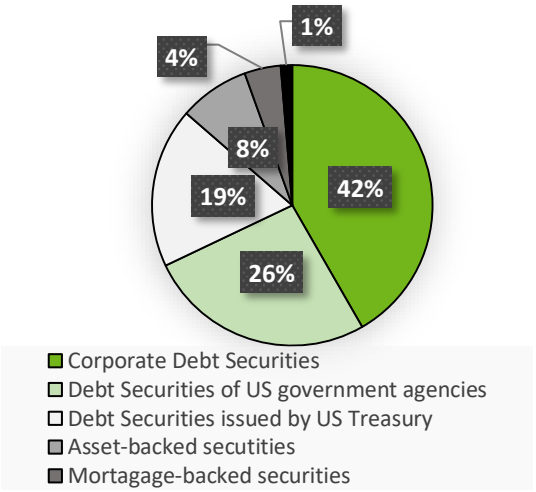
**Economic Risk 2 – Foreign Exchange Rate Risk (Impact – Low; Probability – Medium)**

Historically, the impact of foreign exchange rate risk was minimal in NVIDIA since sales and arrangements with third-party manufacturers are done in US dollars, registering a loss of 0.4% of total revenue in FY2017 and a gain of 0.3% and 0.1% in FY2015 and FY2016 respectively. According to Trading Economics, the dollar exchange rate is expected to appreciate against other currencies in 2019 and 2020 due to an increase of the interest rates that will increase the demand for dollars. For NVIDIA this can lead to a loss of competitiveness, even if the operating expenses can decrease with a strong dollar. Nevertheless, NVIDIA entered into foreign currency forwards to mitigate this risk. In FY2015 this hedge resulted in a gain of $3 million and in FY2016 and FY2017 in a loss of $12 million in both years.

**Legal Risk – IP disputes (Impact – Medium; Probability – High)**

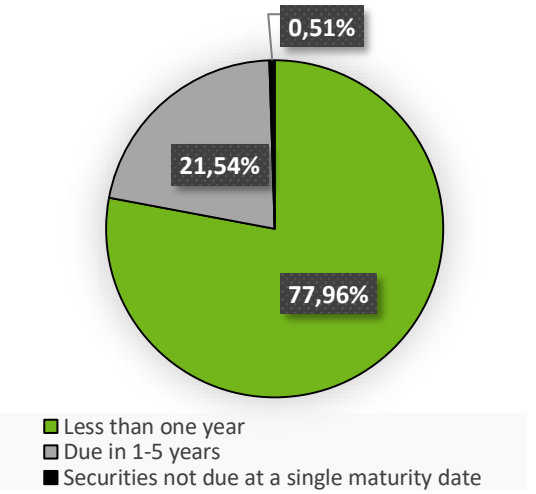
In the technology industry, intellectual property is one of the pillars to succeed. With more than 2.300 patents, NVIDIA frequently sues other companies, and is sued. This IP disputes can be very expensive affecting the company financial results and can lead to a manufacturing suspension or payment of royalties. In 2014, NVIDIA sued Samsung and Qualcomm for infringement of various patents. In response, Samsung sued NVIDIA also for infringement of patents, which started a patent war between the two companies. One year later, NVIDIA lost the two cases that cost $70 million in 2016 and $57 million in FY2017 and $11 million in FY2018. Nevertheless, in the past NVIDIA never had to halt the production of one of their products. Otherwise, it would have a major impact on NVDIA revenue.

**Figure 30: Summary of NVIDIA Marketable Securities in 2018 (Total = $3106 million)**



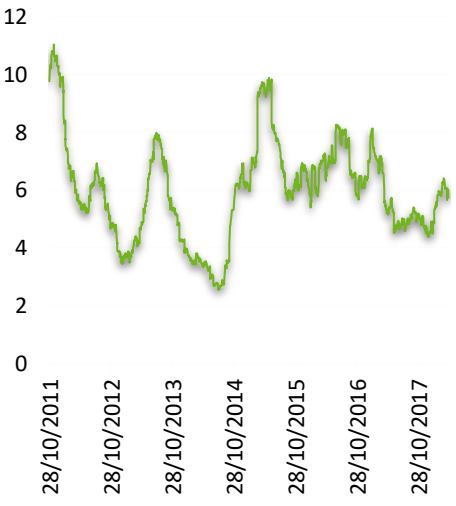

Source: Financial Report 2018

**Figure 32: Marketable Securities and Cash Equivalents – Maturities in 2018 (Total = $6895**




Source: Financial Report 2018

**Figure 31: Bloomberg Dollar Spot Index - Hist Volatility (60)**




Source: Bloomberg

## *Risks to Price Target - Sensitivity Analysis*

In order to have an objective idea of the main risks and its impacts a sensitivity analysis was performed. There are several risks listed above that, if they occur, will affect NVIDIA stock price. The identification of new products, the loss of main costumers and the volatility of cryptocurrency are examples of some of the risks. To measure the impact of revenue, there is assumed the hypothesis of, one single risk or a set of them, decreasing the revenue growth rate by -20 p.p, -10 p.p, -5 p.p, -2 p.p and 0% per year and decreasing the revenue growth rate by one third and one half. Also studying the hypothesis of a positive impact of one risk, for example, the increase of a stable demand by crypto miners. As the table presented below suggests, a revenue decrease of 12% will change the initial target by -28,90%, giving us a sell recommendation. If the revenue growth is one third of what was initial projected there will be a change to initial target of -4,32%

As was mention before NVIDIA is in an economy that is increasingly protectionism. One of the risks of this policy is the forbiddance of the fabless manufacturing, and the obligation of having their own factories in USA. For the first years this will have an impact in the gross margin and in the cap. ex growth. As we can see the price target is very sensitive, changing the recommendation with variation in almost any direction of this variables.

In a highly competitive industry, there is always the hypothesis of new competitors or new technologies that substitute the current ones. This can reduce the market share in the future and obligate NVIDIA to increase the costs in R&D. As this sensitivity analysis demonstrate, a variation of 3% or -1,5% of R&D cost to sales per year, keeping the same terminal growth rate, will change the recommendation in -9,5% and 4,8%, respectively. As for the terminal growth rate, a 0.5% or -0.5% variation will have an impact of 23,1% and -15,1%, respectively, with same the amount of R&D costs. (More sensitivity analysis can be seen in appendix 17).

**Table 5: Effects of change in revenue growth rate**

| | Change in revenue growth rate | | | | | | |
|---|---|---|---|---|---|---|---|
| | -20% | -10% | -5,0% | -2% | 1 | 1/3 | 1/2 |
| DCF fair price | 190,19 | 246,93 | 275,30 | 292,32 | 303,67 | 290,55 | 293,83 |

Source: Author calculations

**Table 6: Effects of change in Gross Margin and in Cap. Ex YoY growth**

| | | Gross Margin | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 303,67 | 64,9% | 62,9% | 60,9% | 59,4% | 57,9% | 56,4% | 54,9% |
| Change in Cap Ex | 7,60% | 295,60 | 276,32 | 257,03 | 242,57 | 228,11 | 213,65 | 199,19 |
| | 6,10% | 311,14 | 291,86 | 272,58 | 258,12 | 243,66 | 229,19 | 214,73 |
| | 4,60% | 326,69 | 307,41 | 288,13 | 273,66 | 259,20 | 244,74 | 230,28 |
| | 3,10% | 342,24 | 322,95 | 303,67 | 289,21 | 274,75 | 260,28 | 245,82 |
| | 1,60% | 357,78 | 338,50 | 319,22 | 304,75 | 290,29 | 275,83 | 261,37 |
| | 0,10% | 373,33 | 354,05 | 334,76 | 320,30 | 305,84 | 291,38 | 276,91 |
| | -1,40% | 388,87 | 369,59 | 350,31 | 335,85 | 321,38 | 306,92 | 292,46 |

**Table 7: Effects of change in Cost of R&D to sales and Terminal growth rate**

| | | Cost of R&D to sales | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 303,67 | 15,50% | 17,00% | 18,50% | 21,50% | 24,50% | 27,50% | 30,50% |
| Terminal growth rate | 1,30% | 220,30 | 210,88 | 201,45 | 182,59 | 163,74 | 144,88 | 126,03 |
| | 1,80% | 246,64 | 236,04 | 225,43 | 204,21 | 182,99 | 161,78 | 140,56 |
| | 2,30% | 282,15 | 269,95 | 257,75 | 233,35 | 208,95 | 184,55 | 160,14 |
| | 2,80% | 332,59 | 318,13 | 303,67 | 274,75 | 245,82 | 216,90 | 187,97 |
| | 3,30% | 409,95 | 392,02 | 374,09 | 338,23 | 302,37 | 266,51 | 230,65 |
| | 3,80% | 543,55 | 519,63 | 495,71 | 447,87 | 400,03 | 352,19 | 304,35 |
| | 4,30% | 829,81 | 793,05 | 756,30 | 682,79 | 609,28 | 535,77 | 462,26 |

Source: Author calculations

## *Monte Carlo simulation*

For the Monte Carlo simulation, we used Crystal Ball program. Based in hundred thousand trials and with several assumptions (Gross Margin percentage, Equity Risk Premium, Days Sales Outstanding, and more), there was a study of which are the ones with more impact in our forecast variable, the price target (more information about the assumptions and their distributions in appendix).

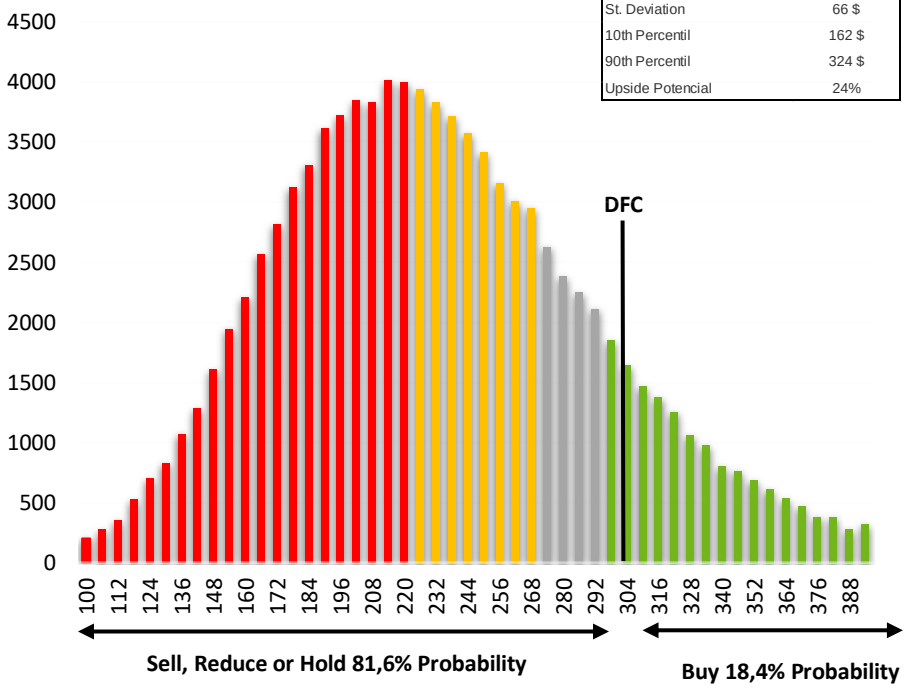
Monte Carlo simulation report a mean price target of 239$. The distribution resulted by the trials, have a skewness of 0,81 , which means that there a higher probability of the price target to reach extreme values. Also, have a kurtosis of 4.66, that is higher than the kurtosis of a normal distribution, 3, which means that, compared to a normal distribution, its tails are longer and fatter, and often its central peak is higher and sharper.

Regarding the Monte Carlo sensitivity price distribution, the Gross Margin (%), the Equity Risk Premium and the R&D to revenue ratio, are the variables that have the higher impact on NVIDIA price target.

Finally, according to the trial values, there is a 18,4% probability of a Buy recommendation, a 10,3% probability of a Hold recommendation, a 29,2% probability of a Reduce recommendation and a 42,1% probability of a Sell recommendation.

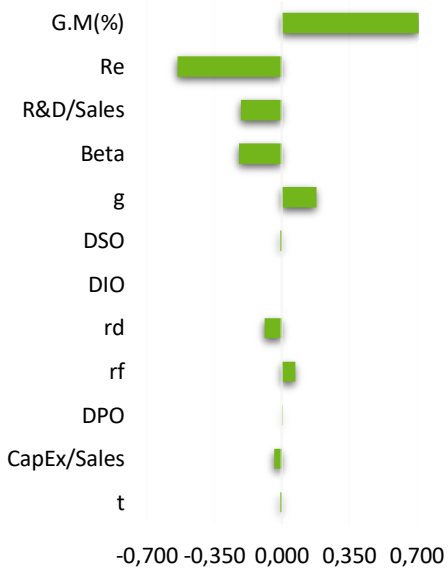
**Figure 35: Monte Carlo Price distribution**

| Monte Carlo Statistics | |
|---|---|
| N° of trials | 100000 |
| Mean | 239 $ |
| St. Deviation | 66 $ |
| 10th Percentil | 162 $ |
| 90th Percentil | 324 $ |
| Upside Potencial | 24% |



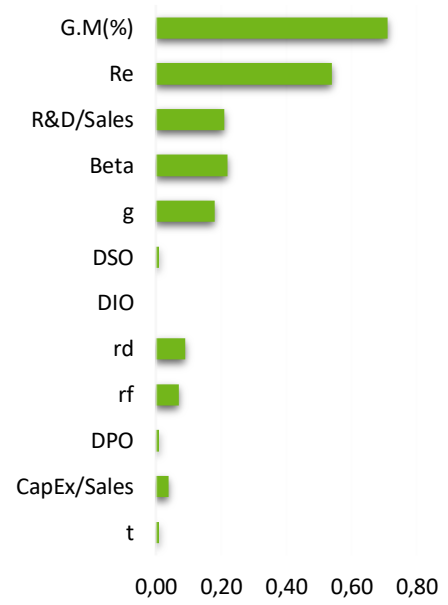

Source: Crystal Ball

**Figure 33: Assumptions Sensitivity to P.T**




Source: Crystal Ball

**Figure 34: Rank Correlation**




Source: Crystal Ball

# Valuation

## *Discounted Cash Flow (DCF) method: Free Cash Flow to the Firm*

The price target, using this method, is based in the cash flow generated by the firm for the next years that is discounted with the WACC rate. With this Enterprise Value and considering the net debt we reach the Market Value of Equity. To achieve this Value of Equity, a various number of assumptions were needed.

### Assumptions Analysis

***Revenues***

- **Gaming**

NVIDIA had faced a five-year CAGR of 32.26% growth in gaming revenue. As was mention before, the gaming market is expected to have high growth rate in the next years, sustained by the increase of Esports, the capacity of game producers to include new technologies in the games and partnerships with console manufacturers. According to (NewZoo, 2018) the global Esports Economy will grow to $905.6 million, up 38% YoY. This also will influence the number of total gamers that, according to the same report, will from 1815 million gamers in 2014 to 2725 million in 2022. Although for NVIDIA, the increase in demand by crypto miners and the growth of the semiconductor industry leaded to a rise of silicon wafer prices. The demand by crypto miners can be analyzed through the perform of the main seller of crypto mining hardware Bitmain (its market share is 75 percent according to theirs Application Proof (Bitmain Technologies Holding Company, 2018). From just $137.3 million in 2015, Bitmain's sales logged a blistering 328% CAGR to reach $2.5 billion in 2017. Ultimately these factor will have as consequence the raise of gaming GPU prices, which will result in consumers changing to AMD graphic cards that will become more price-efficient. Thus, we expect a slowdown in revenue growth rate and in market share.

- **Professional Visualization**

Professional visualization had a five-year CAGR of 4.22%. For the near future, we expect a decrease in YoY revenue growth for next year's due to higher competition in this market and weakness of workstations market as a result of high installation costs and others. With the adaptation of VR/AR technology in the emergence of the Industry 4.0 will boost the revenue in a long term.

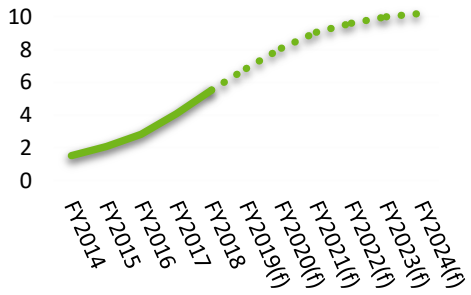
- **Data Center**

With a five-year CAGR of 56,83%, the growth of NVIDIA datacenter is going along with the market. The strong bet in AI allowed NVIDIA to supply GPU´s that are faster, more efficient and with higher functionality than its competitors, that powers the algorithms of Facebook and Google. NVIDIA is currently dominating the AI space and is charging a premium price for its GPUs. Given the strong demand for GPU accelerators for datacenters, many companies are investing in AI to compete for the leading spot. Thus, in the next years, it is very unlikely that NVIDIA will sustain the previous YoY growth rates with new companies and its new accelerators in this market that will reduce NVIDIA market share but still being the reference of AI accelerated computing with high growth revenue in this market until the market reaches a mature state.

- **Automotive**

The market that we expect to have more potential in the future is the automotive. With a five-year CAGR of 43,23%, we foresee the highest growth in comparison of all other markets in the long-term. In the short-term with a five-year CAGR of 43,23% and a trend for incorporation of ADAS in cars, will allow NVIDIA to increase its revenue. In

**Figure 36: Gaming Revenue ($Billions)**

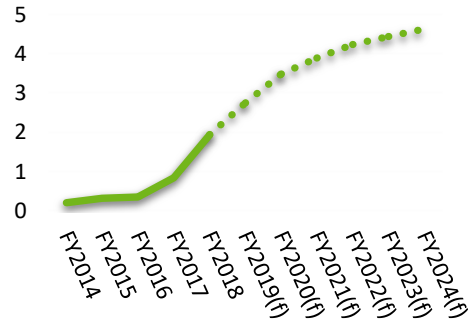



Source: Author analysis and estimates

**Figure 37: P.V Revenue ($Millions)**

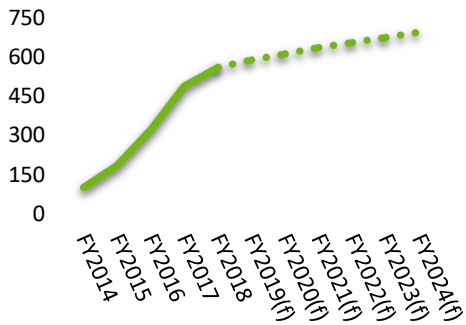

Source: Author analysis and estimates

**Figure 38: Data Center Revenue ($Billions)**




Source: Author analysis and estimates

**Figure 39: Automotive Revenue ($Millions)**




Source: Author analysis and estimates

the long-term, besides the constraints and recent events of fully autonomous cars that will limit a full potential growth in the near future, we expect a much higher growth with the lighten of regulation and NVIDIA efforts to partnership with the biggest car manufacturers.

- **OEM & IP**

Relatively to the license agreement revenue, there was boosted by the royalties paid by Intel in the last five years. This agreement was closed in the first quarter of fiscal year FY2018 and with the recent partnership between Intel and AMD, there is not expectation for a new deal. Also, NVIDIA pursuit a license agreement with Samsung, that responded with a negative answer that lead the patent war. The ITC ruled that Samsung did not infringe the patents we asserted in FY2017, and there are no further major license agreements in the near future. Thus, the revenue of OEM & IP will be equal to the FY2018 nominal value.

***Cost of Revenue***

As NVIDIA operates in fabless manufacturing, the cost of revenue is composed by the cost of semiconductors purchased from subcontractors, including wafer fabrication, assembly, testing and packaging, board and device costs, manufacturing support costs, including labor and overhead associated with such purchases, final test yield fallout, inventory and warranty provisions, memory and component costs, and shipping costs. Also includes development costs for license and service arrangements and stock-based compensation related to personnel associated with manufacturing. The computation of this cost was based in a five-year historical average.

***Operating Costs***

These operating costs are driven employee additions and compensation, including stock-based compensation as well as intellectual property disputes costs and wind down costs that are included in R&D, SG&A and Restructuring and Other Charges. We assume that operating costs are directly influenced by the revenue, so we based these assumptions in a revenue ratio. Due to one-time events as Samsung and QUALCOMM legal disputes and the wind down of ICERA, we decide to base this assumption only in the FY2017 revenue.

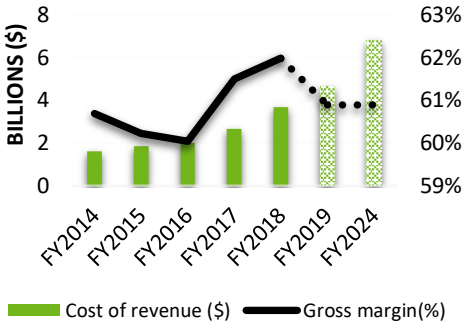
***Capital Expenditures and Depreciation and Amortization***

The Capital Expenditures were based in based on a 5-year YoY historical average. For the calculation of Cap. Ex, we took out the building value in FY2018 that is considered one-time event. Since NVIDIA revenue is growing in average 21,38% we decided not to link this item with revenues. For Depreciation and Amortization expenses, we assumed a 5-year historical average of dep & amort exp to total PPE&IA ratio. Being the Amortization expenses disclosed in the financial report, we assume the depreciation expenses as the total D&A minus the amortization.

***Net Working Capital (NWC)***

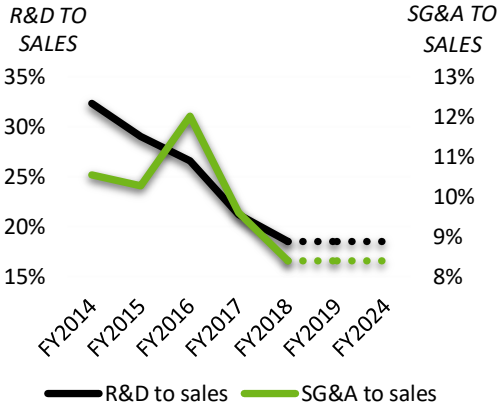
In the last years, as for the next periods NWC was and will be always positive, with the current assets being higher than the current liabilities. For current assets, we have Inventories and Accounts Receivables, that were estimated based in the 5-year average DIO and DSO. As for deferred income tax, it is being zero since FY2016, and we expect that will continue equal to that nominal value. To forecast Prepaid Expenses and other Current Assets, we used a 5-year historical average of this item to total assets ratio. Regarding the current liabilities, the computation of Accounts Payable, was based on a A/P turnover 5-year historical average. Finally, up until FY2017, Total Accrued Liabilities and other, was mainly composed by deferred revenue, where was included the cross-licensing agreement with Intel Corporation that expired in FY2017

**Figure 40: Cost of Revenue**



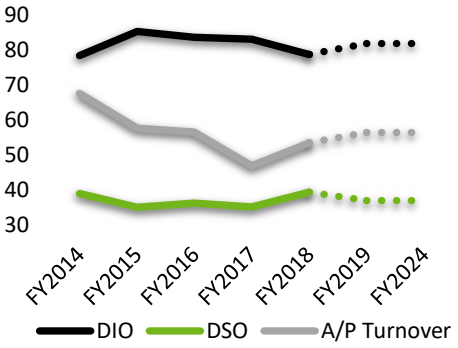

Source: Annual Report

**Figure 42: Operating Costs**



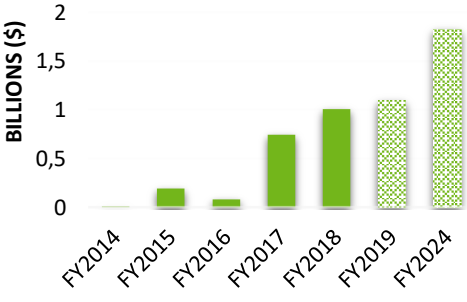

Source: Annual Report

**Figure 41: Efficiency Ratios (days)**




Source: Annual Report

**Figure 43: Net Working Capital**




Source: Annual Report

and gave rise to the abnormal variation in that year. Considering this, we assumed FY2017 variation as a one-time event and FY2018 growth as assumption for the next years.

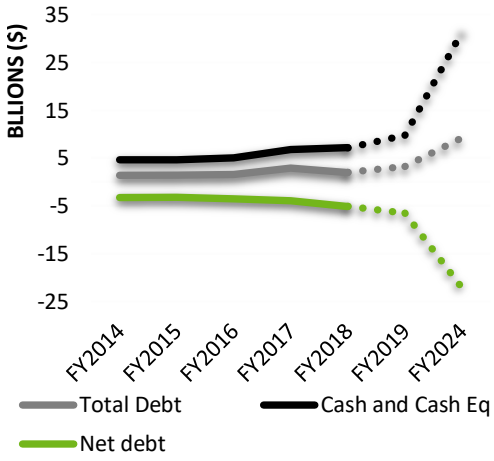
***Debt and Net Debt***

For total debt we assumed a 5-year historical average debt to equity ratio. Short-term debt was mainly composed by convertible debt in FY2016, FY2017 and FY2018. There is only convertible short-term debt if the price of the common stock was greater than or equal to 130% of the conversion price for at least 20 trading days during the 30 consecutive trading days. We assumed that this will not happen in the next years. In the first quarter report of FY2019 there is a decrease of one million in convertible debt. We assume that this decrease will happen each quarter with a total of 4 million in each year. For long-term debt, we subtract the short-term debt of the total debt. For Net Debt, through the last years, NVIDIA has always a negative net debt that increased over the years. With the expectations of higher cash and cash equivalents in the future, the Net Debt will have a higher absolute value in the next years.

**Figure 44: Debt to equity**


Source: Annual Report

**Figure 45: Debt and Net Debt**




Source: Annual Report

***WACC Assumptions***

The WACC was the method chosen to compute the rate that will be used to discount the cash flows.

- **Equity Risk Premium (ERP)**

ERP were based on Damodaran's Country Default Spreads and Risk Premiums. For USA, where NVIDIA headquarters are located, the Moody's rating is Aaa which correspond to a risk premium of 5,08%

- **Beta**

For Beta, the Analysis ToolPack were used. Based in S&P500 and NVIDIA 10-year daily variation, the regression statistics has a coefficient of 1,3295. More details about the output in appendix.

- **Free-risk Rate**

We assumed the 30-year treasury yield of USA as an approximation of the Free-Risk Rate.

- **Required Return on Equity**

Based in the variables listed previously, this return was computed using Capital Asset Pricing Model (CAPM)

- **Cost of Debt**

Currently NVIDIA has two Notes outstanding, $1.00 billion of the Notes Due 2021, and $1.00 billion of the Notes Due 2026. The yield to maturity of 2026 Note was considered a good approximation of the cost of debt.

- **Tax Rate**

For the tax rate we used the marginal tax rate instead of the effective tax rate, which was based on 5-year historical average.

***Terminal Growth Rate***

For this rate, we assumed the World GDP growth rate average between 2011 and 2022(f) provided by the World Bank.

**Table 8: Required Return on Equity**

| Required return on equity (re) | |
|---|---|
| Equity Risk Premium | 5,08% |
| Beta | 1,33 |
| Free-risk rate (rf) | 2,93% |
| Required return on equity (re) | 5,79% |

Source: Author analysis and estimates

**Table 9: Cost of debt**

| Cost of debt | |
|---|---|
| NVIDIA 2026 Note | |
| Par Value of Bond | 99,80 |
| Coupon Rate Annual | 3,20% |
| Coupons per Year | 2 |
| Years to maturity | 8,34 |
| Current price of Bond | 96,60 |
| Yield to Maturity | 3,65% |

Source: Author analysis and estimates

**Figure 46: World GDP Growth (annual %)**


Source: World Bank

## *Relative Valuation Approach*

### Selection of peers

The first requirement to select the peers for all existing companies was to be in the Semi-Conductor industry. After that, one company to be considered as peers, needs to have a similar business structure, being active in similar markets as NVIDIA. Also, the size and growth stage of each potential peer was considered, using market capitalization, 5-year average sales growth, and return of equity. Finally adjusted beta and correlation between NVIDIA and potential peer's stock daily variation. The companies that fills most requirements were considered comparable companies. More information about the peer selection in Appendix 16. Following these criteria's, we conclude that none of the companies selected can be considered as peers. Although, to perform this valuation was selected the companies which are more comparable to NVIDIA.

**Table 10: NVIDIA's Selection of Peers**

| NVIDIA's Peer? | |
|---|---|
| Advanced Micro Devices | Yes |
| Intel Corporation | Yes |
| Xilinx, Inc | Yes |
| Ambarella, Inc. | No |
| Broadcom Ltd. | Yes |
| Qualcomm Incorporated | No |
| Renesas Electronics Corporation | No |
| Texas Instruments Incorporated | Yes |
| Samsung | No |

Source: Author analysis and estimates

### Multiples Valuation

The forward multiples used to this valuation are P/E, P/B, EV-to-EBITDA ratio and EV-to-Sales ratio.

- **Price-to-Earnings ratio**

Using P/E ratio, we reach a price target of $381,59. Comparing to DCF valuation, they are not in accordance. This overvalued valuation is due a P/E of 245,43 by AMD which inflated the peer's average.

**Table 11: Multiples Valuation**

| Multiples | Price target ($) |
|---|---|
| Price-to-earnings ratio | 381,59 |
| Price-to-book ratio | 109,40 |
| EV-to-EBITDA ratio | 119,02 |
| EV-to-Sales ratio | 68,85 |

Source: Author analysis and estimates

- **Price-to-Book ratio**

For P/B ratio, NVIDIA price target is $109,02 that also is not in accordance with DCF valuation. This difference is motivated mainly by Intel and Broadcom that have a P/B of 2,43 and 2,01, respectively, which is between seven and nine times less than NVIDIA (18,93).

- **EV-to-EBITDA ratio**

Based on EV-to-EBITDA forward ratio, the NVIDIA price target will be $119,02. This differ $171,72 from DCF valuation, due to a difference between NVIDIA ratio of 40,17 and peers average of 16,03.

- **EV-to-Sales ratio**

For EV-to-Sales ratio, we reach a price target of $68,85. In the follow up of the previous multiple valuations, this is not in accordance with DFC valuation. NVIDIA have EV/S ratio of 17,93, while the peer's average is 4,01.

After evaluating all the multiples, we can conclude that, relatively to their peers, NVIDIA is a company in a difference growth stage and different main market, with different characteristics. Upon this date, NVIDIA is the strongest company of its main market rivaling with a company that is facing some financial and structure problems.

**Table 12: Peer's business markets**

| | Gaming | P.V | D.C | Auto | SoC |
|---|---|---|---|---|---|
| NVIDIA | Yes | Yes | Yes | Yes | Yes |
| AMD | Yes | Yes | Yes | Yes | Yes |
| Intel | No | No | Yes | Yes | Yes |
| Xilinx | No | Yes | Yes | Yes | No |
| Ambarella | No | No | No | No | Yes |
| Broadcom | No | No | Yes | No | Yes |
| Qualcomm | No | No | No | Yes | Yes |
| Renesas | No | No | No | Yes | Yes |
| T.I | No | No | Yes | Yes | Yes |
| Samsung | No | No | Yes | Yes | Yes |

Source: Author analysis and estimates

**Table 13: Multiples Valuation**

| | Multiples | | | |
|---|---|---|---|---|
| | Price-to-earnings ratio | Price-to-book ratio | EV-to-EBITDA ratio | EV-to-Sales ratio |
| Nvidia | 51,16 | 18,93 | 40,17 | 17,93 |
| Intel Corporation | 17,44 | 2,43 | 9,23 | 3,04 |
| Advanced Micro Devices Inc | 245,43 | 17,27 | 31,82 | 2,08 |
| Xilinx, Inc | 25,48 | 6,33 | 20,09 | 6,52 |
| Texas Instruments Inc. | 21,29 | 7,58 | 11,57 | 5,40 |
| Broadcom Ltd. | 26,09 | 2,01 | 7,43 | 3,00 |
| **Arithmetic mean** | **67,15** | **7,12** | **16,03** | **4,01** |

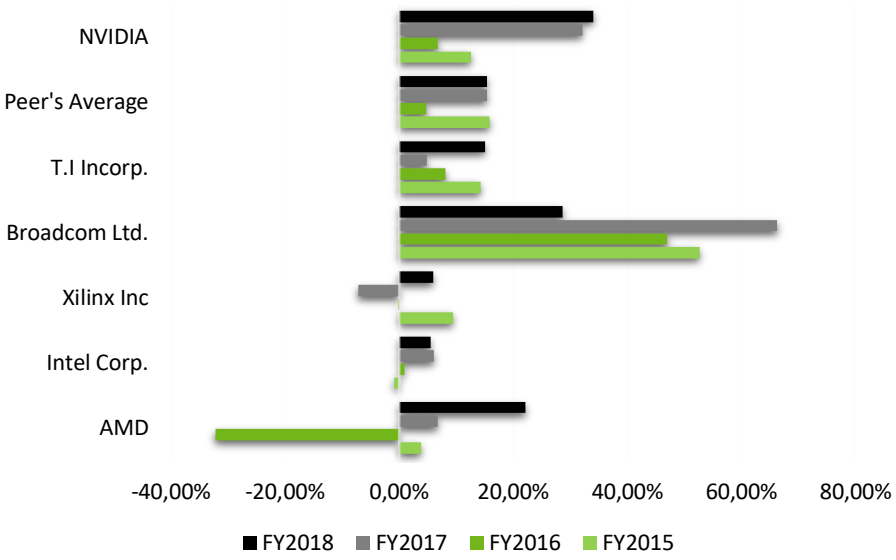
Source: Author analysis and estimates

# Financial Analysis

### In the path of stable earnings

In the last years NVIDIA showed abnormal earnings growth comparing with peers. Since FY2014 until FY2018, NVIDIA had a total comprehensive income CAGR of 600%. This exponential increase was due to an increase of revenue, with economies of scale and the stable debt strategy without short term debt that allowed low interest expenses. NVIDIA has overtaken the discrete GPU market with a 265% rise in revenue and showed as a big competitor in the data center market registering an 871% growth in this market. As for total revenue, NVIDIA has a 31.4% YoY growth in FY2015, with a 6.77% revenue growth breakdown in FY2016 due to the wind down of Icera. Afterwards NVIDIA had high revenue growth rates with 32.15% in FY2017 and 34.06% in FY2018. In this period, NVIDIA followed the peer's average growth rate until FY2016 and registered, in FY2017 and FY2018, growth rates that were more than the double of peers. For the future, total revenue growth is expected to be more stable, being almost impossible to maintain these rates, with a 22.68% YoY growth in FY2019 going to a 2.67% YoY growth in FY2024. Alongside with revenue is COGS, that are expected to growth as well due to a future pressure of semiconductors inputs demand as silicon wafer, decreasing 1 percentage point to an 60.89% gross margin that is expected to be constant in the next five years.

**Figure 49: NVIDIA vs Average Peer's Revenue YoY Growth Rate**

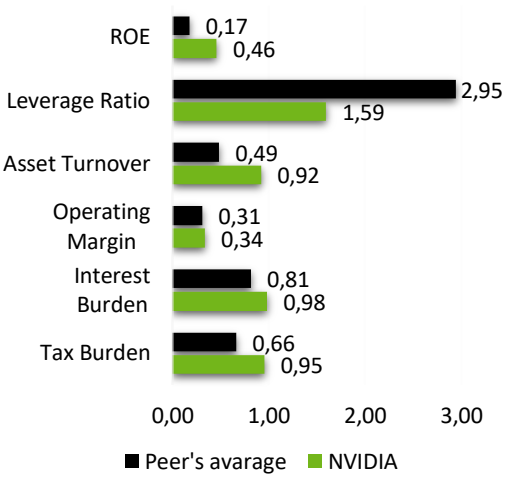



Source: Annual Reports

### Rentability Analysis

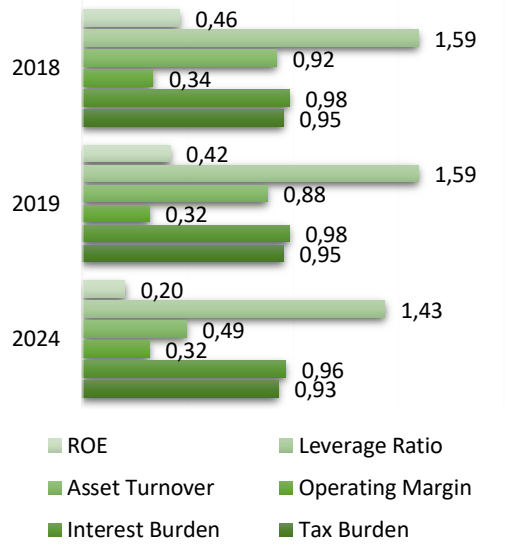
Since 2014 the return on equity (ROE) of NVIDIA has been showing an improvement passing from 10,4% to 46,1%. Through the DuPont analysis we can conclude that such behavior was due to an increase of efficiency and productivity of the company assets. The efficiency measured by the gross margin is considerably high with 61,98% in FY2018, compared to the average of the main peers with 50,4%. Comparing with the last years, there was a slightly increase coming from a 60,70% in FY2014. The asset productivity, measure by the asset turnover, has increased 34 percentage points (in FY2014 the asset turnover was 0.60) between FY2014 and FY2018, being almost the double of the average turnover of the main industry peers. Such evolution resulted from the increase of revenue without the correspondent increment of new assets. For the future is expected a decrease of the asset turnover, to 0.49 in FY 2024, with the increase of total assets.

**Figure 47: NVIDIA vs Peer's ROE**



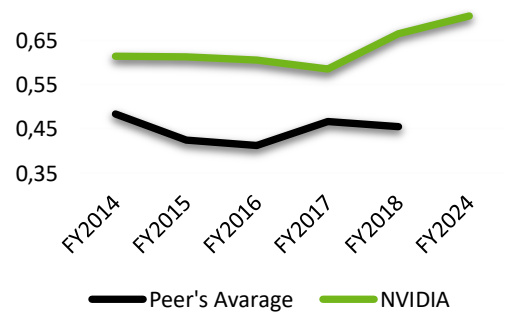

Source: Annual Reports and Author calculations

**Figure 48: NVIDIA Future ROE**



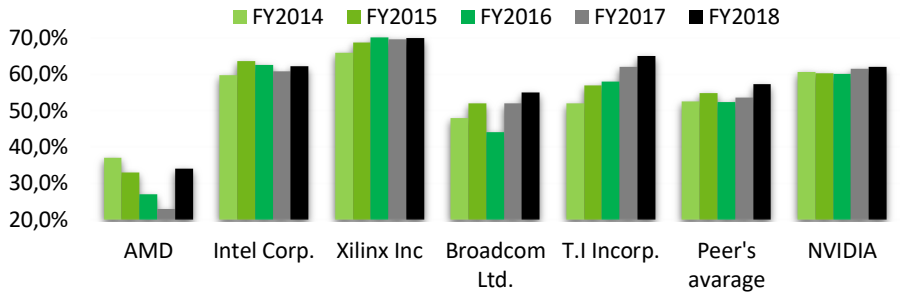

Source: Annual Reports and Author calculations

**Figure 50: NVIDIA vs Peer's Shareholder Equity Ratio (times)**



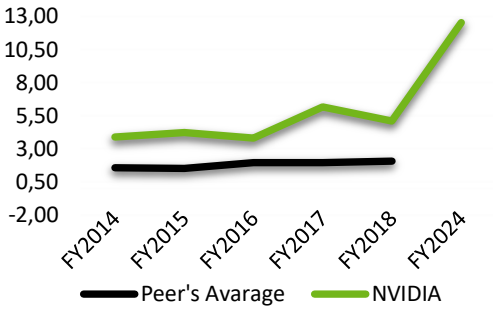

Source: Annual Reports and Author calculations

**Figure 51: NVIDIA vs Peer's Gross Margin Percentage**



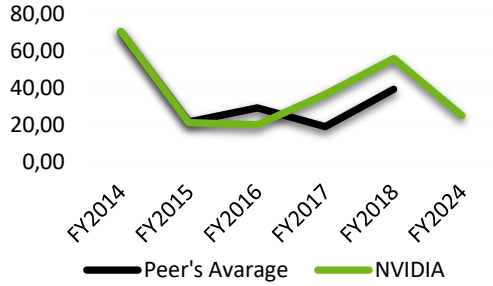

Source: Annual Reports

**Figure 52: NVIDIA vs Peer's Non-Current Assets Coverage (times)**



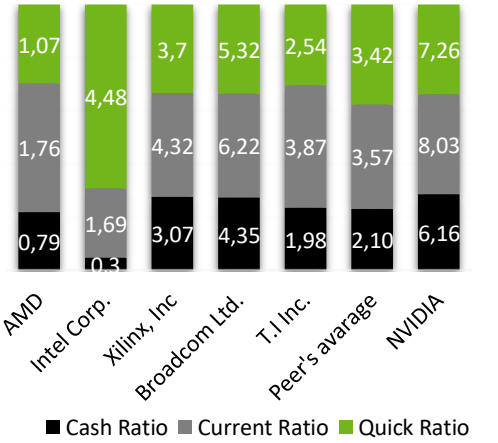

Source: Annual Reports and Author calculations

**Figure 53: NVIDIA vs Peer's Times Interest Earnings (times)**



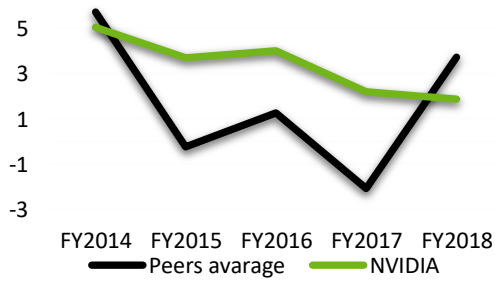

Source: Annual Reports and Author calculations

**Figure 54: NVIDIA vs Peer's Liquidity Ratios (%)**




Source: Annual Reports and Bloomberg

**Figure 55: NVIDIA vs Peer's DOL (times)**




Source: Annual Reports and Author calculations

### Financial Strength Analysis

Between FY2014 and FY2018 the shareholder equity ratio has increased from 0.61 to 0.66, which means that the company assets were financed in 61% by shareholder equity, and four years later, 66% of total assets were financed by equity. Regarding the non-current assets coverage, NVIDIA meets what is known as the minimum financial equilibrium rule by a far margin, with the percentage of non-current assets being financed by capital employed increased from 388% in FY2014 to 656% in FY2018. In terms of refund capacity there is a negative variation but with strong numbers, with the operational income covered about 70,40 times the financial expenses in FY 2014 and 55.52 times in FY2018.

### Liquidity Analysis

Regarding liquidity, NVIDIA registered, in the last years, liquidity ratios above one, which means that the current assets are higher than the current liabilities required. With a cash ratio, current ratio and quick ratio of 6.16, 8.03 and 7.23, respectively, they are above with a long margin of the peer's average of 2.098, 3.572 and 3.422, respectively in FY2018. For the next year there is an expectation of a constant cash ratio of 6.16, a current ratio increases to 18.99 and a quick ratio increases to 17.96 all in FY2024.

### Cash Conversion Cycle Analysis

The cash conversion cycle (CCC) increased from almost 50 to 64 days in five years. The variation of 14 days was originated mainly by a negative variation in days payable outstanding (DPO) in FY2015 of 10 days. The DPO, that in the beginning of the period was above the peer's average (44 days), has been decreasing. This variation could be related to a lower bargaining power with the suppliers, which are demanding lower payment terms. Regarding the days sales outstanding (DSO) and days inventory outstanding (DIO), they have been constant through the years, with variation of -0.4 and 0.3 days, respectively. Comparing with the peer's average, NVIDIA have a similar DSO (39.28 to 38.53 in FY2018), and a lower DIO (78,57 to 92,71). Despite the CCC variation, it is still lower than the peers average of 89,8 days which indicates the strong liquidity that NVIDIA have.

### Risk Analysis through Degrees of Leverage

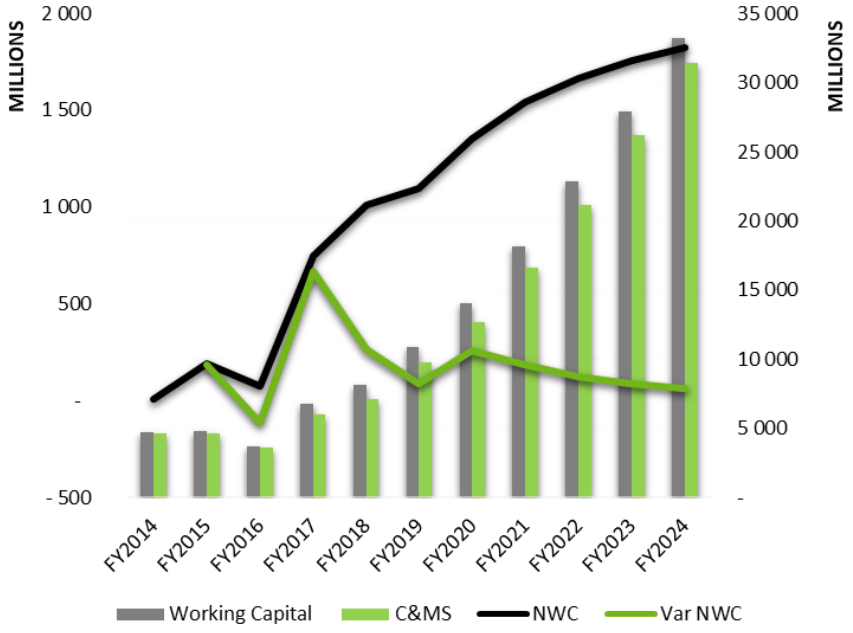
Between FY2014 and FY2018, NVIDIA significantly decreased the Degree of Combined Leverage (DCL) from 5,16 in FY2014 to 1.88 in FY2018. This was mainly due to the economic effect measured by the Degree of Operating Leverage (DOL) (5.05 in FY2014 and 1.88 in FY2018). The financial risk measured by the Degree of Financial Leverage (DFL), has been constant through the period in analysis (from 1.022 to 1.019). Comparatively to the peer's, NVIDIA presents a similar economic risk (5.73 to 5.05) in FY2014, although increasing the difference afterwards (3,72 to 1,88). This means that while 1% variation on NVIDIA sales would cause a 1,88% change in operating income, on the peer's average, 1% variation on sales would cause a 3.72% in operating income. Regarding the DFC, NVIDIA present a better performance (0.55 to 1.022) in FY2014, with this gap being decreasing afterwards (1.38 to 1.01 in

FY2018). In general, the risk of NVIDIA is lower than the average peer's (3.13 in FY2014 and 5.15 in FY2018). For the next years, is expected a constant DOL, DFL and DCL with 1.94, 1.05 and 2.02, respectively, in FY2024.

### Short-Term Financial Equilibrium Analysis

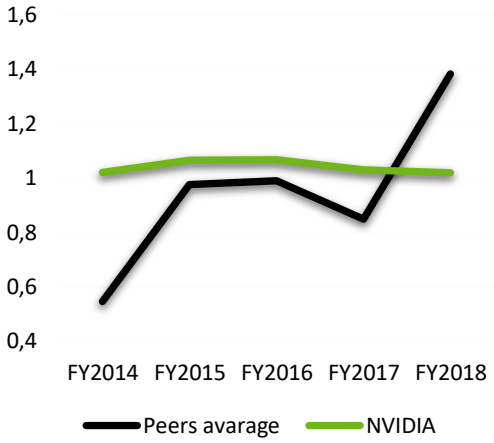
The Working Capital (WC) and Net Working Capital (NWC) analysis suggests a strong financial equilibrium, which had been improving over the last years, going from a cash and marketable securities of 4.7 in FY2014 to 7.093 billion dollars in FY2018. This means that the WC were always higher that the NWC which has allowed the non-use of short-term debt. The WC has been increasing reaching 8.1 billion dollars in FY2018, which indicates that the non-current assets are not being finance by short-term required capital. The NWC, had a growth rate of 489% between FY2014 and FY 2018 and is expected to increase even further in the next years. From this variation we can conclude that there was an aggravation of the operation cycle of the NVIDIA, that is, an aggravation of the capacity of the company to convert inventory or accounts receivables from clients and the of the capacity of obtaining unpaid financial resources of their suppliers. That way, despite the NWC increase, the risk of non-compliance with their short-term obligations is very low.

**Figure 57: Short-Term Financial Equilibrium ($)**



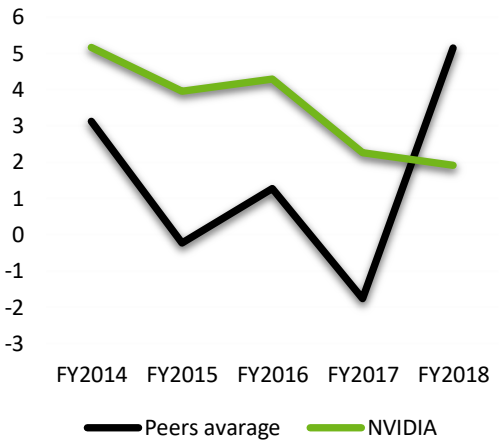

Source: Annual Reports and Author calculations

**Figure 56: NVIDIA vs Peer's DFL (times)**




Source: Annual Reports and Author calculations

**Figure 58: NVIDIA vs Peer's DCL (times)**




Source: Annual Reports and Author calculations

# Appendix

### *Appendix 1: Historical Income Statement*

| Statements of Income | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|
| **Revenue** | **4 130 000 000** | **4 682 000 000** | **5 010 000 000** | **6 910 000 000** | **9 714 000 000** |
| Cost of revenue (Excluding D&A) | 1 623 251 000 | 1 862 030 000 | 2 002 000 000 | 2 660 000 000 | 3 693 000 000 |
| **Gross Profit** | **2 506 749 000** | **2 819 970 000** | **3 008 000 000** | **4 250 000 000** | **6 021 000 000** |
| Research and development | 1 335 834 000 | 1 359 725 000 | 1 331 000 000 | 1 463 000 000 | 1 797 000 000 |
| Sales, general and administrative | 435 702 000 | 480 763 000 | 602 000 000 | 663 000 000 | 815 000 000 |
| Restructuring and other charges | 0 | 0 | 131 000 000 | 3 000 000 | 0 |
| **Total operating expenses** | **1 771 536 000** | **1 840 488 000** | **2 064 000 000** | **2 129 000 000** | **2 612 000 000** |
| **EBITDA** | **735 213 000** | **979 482 000** | **944 000 000** | **2 121 000 000** | **3 409 000 000** |
| Depreciation and Amortization | 239 148 000 | 220 000 000 | 197 000 000 | 187 000 000 | 199 000 000 |
| **EBIT** | **496 065 000** | **759 482 000** | **747 000 000** | **1 934 000 000** | **3 210 000 000** |
| Interest expenses | 10 443 000 | 46 133 000 | 47 000 000 | 58 000 000 | 61 000 000 |
| Interest income | 17 119 000 | 28 090 000 | 39 000 000 | 54 000 000 | 69 000 000 |
| Other income (expense), net | 7 351 000 | 13 890 000 | 4 000 000 | -25 000 000 | -22 000 000 |
| **Income before income tax** | **510 092 000** | **755 329 000** | **743 000 000** | **1 905 000 000** | **3 196 000 000** |
| Income tax expense | 70 264 000 | 124 249 000 | 129 000 000 | 239 000 000 | 149 000 000 |
| *Implicit marginal tax rate (t)* | | *22%* | *39%* | *9%* | *7%* |
| **Net income** | **439 828 000** | **631 080 000** | **614 000 000** | **1 666 000 000** | **3 047 000 000** |
| **Other comprehensive income (loss), net of tax*** | **-5 104 000** | **2 967 000** | **-12 000 000** | **-12 000 000** | **-2 000 000** |
| **Total comprehensive income** | **434 724 000** | **634 047 000** | **602 000 000** | **1 654 000 000** | **3 045 000 000** |

Source: Company data and Author estimates

## *Appendix 2: Forecasted Income Statement*

| Statements of Income | FY2019E | FY2020E | FY2021E | FY2022E | FY2023E | FY2024E |
|---|---|---|---|---|---|---|
| **Revenue** | **11 917 580 653** | **13 935 385 206** | **15 359 768 046** | **16 275 661 605** | **16 914 884 740** | **17 367 200 504** |
| Cost of revenue (Excluding D&A) | 4 660 874 689 | 5 450 022 625 | 6 007 087 865 | 6 365 286 834 | 6 615 282 116 | 6 792 179 354 |
| **Gross Profit** | **7 256 705 963** | **8 485 362 581** | **9 352 680 181** | **9 910 374 771** | **10 299 602 624** | **10 575 021 151** |
| Research and development | 2 204 642 005 | 2 577 917 152 | 2 841 414 781 | 3 010 846 603 | 3 129 096 961 | 3 212 771 187 |
| Sales, general and administrative | 999 879 373 | 1 169 172 220 | 1 288 677 266 | 1 365 520 301 | 1 419 150 820 | 1 457 099 898 |
| Restructuring and other charges | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total operating expenses** | **3 204 521 378** | **3 747 089 372** | **4 130 092 046** | **4 376 366 905** | **4 548 247 781** | **4 669 871 085** |
| **EBITDA** | **4 052 184 586** | **4 738 273 209** | **5 222 588 135** | **5 534 007 866** | **5 751 354 843** | **5 905 150 066** |
| Depreciation and Amortization | 284 315 334 | 307 377 014 | 341 139 991 | 377 718 437 | 412 077 387 | 442 494 058 |
| **EBIT** | **3 767 869 252** | **4 430 896 196** | **4 881 448 144** | **5 156 289 429** | **5 339 277 457** | **5 462 656 008** |
| Interest expenses | 72 985 745 | 117 667 320 | 117 667 320 | 149 455 348 | 190 047 858 | 235 939 775 |
| Interest income | 33 170 933 | 37 321 392 | 41 991 170 | 47 245 247 | 53 156 731 | 59 807 880 |
| Other income (expense), net | -4 351 800 | -4 351 800 | -4 351 800 | -4 351 800 | -4 351 800 | -4 351 800 |
| **Income before income tax** | **3 723 702 640** | **4 346 198 468** | **4 801 420 194** | **5 049 727 528** | **5 198 034 530** | **5 282 172 313** |
| Income tax expense | 259 591 973 | 302 988 274 | 334 723 329 | 352 033 677 | 362 372 663 | 368 238 194 |
| *Implicit marginal tax rate (t)* | *7%* | *7%* | *7%* | *7%* | *7%* | *7%* |
| **Net income** | **3 464 110 667** | **4 043 210 193** | **4 466 696 866** | **4 697 693 850** | **4 835 661 867** | **4 913 934 119** |
| **Other comprehensive income (loss), net of tax*** | **-2 000 000** | **-2 000 000** | **-2 000 000** | **-2 000 000** | **-2 000 000** | **-2 000 000** |
| **Total comprehensive income** | **3 462 110 6667** | **4 041 210 193** | **4 464 696 866** | **4 695 693 850** | **4 833 661 867** | **4 911 934 119** |

Source: Company data and Author estimates

## *Appendix 3: Historical Common-Size Income Statement*

| Statements of Income | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|
| **Revenue** | **100,00%** | **100,00%** | **100,00%** | **100,00%** | **100,00%** |
| Cost of revenue (Excluding D&A) | 39,30% | 39,77% | 39,96% | 38,49% | 38,02% |
| **Gross Profit** | **60,70%** | **60,23%** | **60,04%** | **61,51%** | **61,98%** |
| Research and development | 32,34% | 29,04% | 26,57% | 21,17% | 18,50% |
| Sales, general and administrative | 10,55% | 10,27% | 12,02% | 9,59% | 8,39% |
| Restructuring and other charges | 0,00% | 0,00% | 2,61% | 0,04% | 0,00% |
| **Total operating expenses** | **42,89%** | **39,31%** | **41,20%** | **30,81%** | **26,89%** |
| EBITDA | 17,80% | 20,92% | 18,84% | 30,69% | 35,09% |
| **Depreciation and Amortization** | **5,79%** | **4,70%** | **3,93%** | **2,71%** | **2,05%** |
| EBIT | 12,01% | 16,22% | 14,91% | 27,99% | 33,05% |
| Interest expenses | 0,25% | 0,99% | 0,94% | 0,84% | 0,63% |
| Interest income | 0,41% | 0,60% | 0,78% | 0,78% | 0,71% |
| **Other income (expense), net** | **0,18%** | **0,30%** | **0,08%** | **-0,36%** | **-0,23%** |
| Income before income tax | 12,35% | 16,13% | 14,83% | 27,57% | 32,90% |
| Income tax expense | 1,70% | 2,65% | 2,57% | 3,46% | 1,53% |
| **Net income** | **10,65%** | **13,48%** | **12,26%** | **24,11%** | **31,37%** |
| **Other comprehensive income (loss), net of tax*** | **-0,12%** | **0,06%** | **-0,24%** | **-0,17%** | **-0,02%** |
| **Total comprehensive income** | **10,53%** | **13,54%** | **12,02%** | **23,94%** | **31,35%** |

Source: Company data and Author estimates

## *Appendix 4: Forecasted Common-Size Income Statement*

| Statements of Income | FY2019E | FY2020E | FY2021E | FY2022E | FY2023E | FY2024E |
|---|---|---|---|---|---|---|
| **Revenue** | **100,00%** | **100,00%** | **100,00%** | **100,00%** | **100,00%** | **100,00%** |
| Cost of revenue (Excluding D&A) | 39,11% | 39,11% | 39,11% | 39,11% | 39,11% | 39,11% |
| **Gross Profit** | **60,89%** | **60,89%** | **60,89%** | **60,89%** | **60,89%** | **60,89%** |
| Research and development | 18,50% | 18,50% | 18,50% | 18,50% | 18,50% | 18,50% |
| Sales, general and administrative | 8,39% | 8,39% | 8,39% | 8,39% | 8,39% | 8,39% |
| Restructuring and other charges | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% |
| **Total operating expenses** | **26,89%** | **26,89%** | **26,89%** | **26,89%** | **26,89%** | **26,89%** |
| EBITDA | 34,00% | 34,00% | 34,00% | 34,00% | 34,00% | 34,00% |
| **Depreciation and Amortization** | **2,39%** | **2,21%** | **2,22%** | **2,32%** | **2,44%** | **2,55%** |
| EBIT | 31,62% | 31,80% | 31,78% | 31,68% | 31,57% | 31,45% |
| Interest expenses | 0,61% | 0,84% | 0,77% | 0,92% | 1,12% | 1,36% |
| Interest income | 0,28% | 0,27% | 0,27% | 0,29% | 0,31% | 0,34% |
| **Other income (expense), net** | **-0,04%** | **-0,03%** | **-0,03%** | **-0,03%** | **-0,03%** | **-0,03%** |
| Income before income tax | 31,25% | 31,19% | 31,26% | 31,03% | 30,73% | 30,41% |
| Income tax expense | 2,18% | 2,17% | 2,18% | 2,16% | 2,14% | 2,12% |
| **Net income** | **29,07%** | **29,01%** | **29,08%** | **28,86%** | **28,59%** | **28,29%** |
| **Other comprehensive income (loss), net of tax*** | **-0,02%** | **-0,01%** | **-0,01%** | **-0,01%** | **-0,01%** | **-0,01%** |
| **Total comprehensive income** | **29,05%** | **29,00%** | **29,07%** | **28,85%** | **28,58%** | **28,28%** |

Source: Company data and Author estimates

## *Appendix 5: Historical Statement of Financial Position*

| Balance Sheet | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|
| **Non-Current Assets** | **1 626 183 000** | **1 488 071 000** | **1 317 000 000** | **1 305 000 000** | **1 986 000 000** |
| - Property and equipment, net* | 582 740 000 | 557 282 000 | 466 000 000 | 521 000 000 | 997 000 000 |
| - Goodwill* | 643 179 000 | 618 179 000 | 618 000 000 | 618 000 000 | 618 000 000 |
| - Intangible Assets, net* | 296 012 000 | 221 714 000 | 166 000 000 | 104 000 000 | 52 000 000 |
| - Other Assets | 104 252 000 | 90 896 000 | 67 000 000 | 62 000 000 | 319 000 000 |
| **Current Assets** | **5 624 711 000** | **5 713 297 000** | **6 053 000 000** | **8 536 000 000** | **9 255 000 000** |
| - Inventories* | 387 765 000 | 482 893 000 | 418 000 000 | 794 000 000 | 796 000 000 |
| - Prepaid expenses and other current assets | 70 285 000 | 70 174 000 | 93 000 000 | 118 000 000 | 86 000 000 |
| - Deferred income taxes | 68 656 000 | 63 403 000 | 0 | 0 | 0 |
| - Accounts receivable, less allowances | 426 357 000 | 473 637 000 | 505 000 000 | 826 000 000 | 1 265 000 000 |
| - Marketable Securities | 3 520 223 000 | 4 126 685 000 | 4 441 000 000 | 5 032 000 000 | 3 106 000 000 |
| - Cash and cash equivalents | 1 151 425 000 | 496 505 000 | 596 000 000 | 1 766 000 000 | 4 002 000 000 |
| **Total assets** | **7 250 894 000** | **7 201 368 000** | **7 370 000 000** | **9 841 000 000** | **11 241 000 000** |
| - Common stock* | 732 000 | 754 000 | 1 000 000 | 1 000 000 | 1 000 000 |
| - Additional paid-in capital | 3 483 342 000 | 3 855 092 000 | 4 170 000 000 | 4 708 000 000 | 5 351 000 000 |
| - Treasury stock | -2 537 295 000 | -3 394 585 000 | -4 048 000 000 | -5 039 000 000 | -6 650 000 000 |
| - Accumulated other comprehensive income | 4 877 000 | 7 844 000 | -4 000 000 | -16 000 000 | -18 000 000 |
| - Retained earnings | 3 504 742 000 | 3 948 877 000 | 4 350 000 000 | 6 108 000 000 | 8 787 000 000 |
| **Shareholders' equity*** | **4 456 398 000** | **4 417 982 000** | **4 469 000 000** | **5 762 000 000** | **7 471 000 000** |
| **Non-current liabilities** | **1 849 000 000** | **1 887 356 000** | **550 000 000** | **2 291 000 000** | **2 617 000 000** |
| - Long-term debt | 1 373 875 000 | 1 398 428 000 | 97 000 000 | 2 020 000 000 | 1 985 000 000 |
| - Other long-term liabilities | 475 125 000 | 488 928 000 | 453 000 000 | 271 000 000 | 632 000 000 |
| **Current liabilities** | **945 496 000** | **896 030 000** | **2 351 000 000** | **1 788 000 000** | **1 153 000 000** |
| - Accounts payable | 324 391 000 | 293 223 000 | 296 000 000 | 485 000 000 | 596 000 000 |
| - Accrued and other current liabilities* | 621 105 000 | 602 807 000 | 642 000 000 | 507 000 000 | 542 000 000 |
| - Convertible short-term debt | 0 | 0 | 1 413 000 000 | 796 000 000 | 15 000 000 |
| **Total liabilities** | **2 794 496 000** | **2 783 386 000** | **2 901 000 000** | **4 079 000 000** | **3 770 000 000** |
| **Total liabilities, convertible debt conversion obligation and shareholders' equity** | **7 250 894 000** | **7 201 368 000** | **7 370 000 000** | **9 841 000 000** | **11 241 000 000** |

Source: Company data and Author estimates

## *Appendix 6: Forecasted Statement of Financial Position*

| Balance Sheet | FY2019E | FY2020E | FY2021E | FY2022E | FY2023E | FY2024E |
|---|---|---|---|---|---|---|
| **Non-Current Assets** | **1 951 758 563** | **2 126 254 168** | **2 324 066 081** | **2 521 375 739** | **2 709 094 067** | **2 883 552 673** |
| - Property and equipment, net* | 1 108 087 574 | 1 249 658 283 | 1 392 616 852 | 1 520 386 440 | 1 632 610 738 | 1 728 438 556 |
| - Goodwill* | 618 000 000 | 618 000 000 | 618 000 000 | 618 000 000 | 618 000 000 | 618 000 000 |
| - Intangible Assets, net* | 26 000 000 | 9 000 000 | 1 000 000 | 0 | 0 | 0 |
| - Other Assets | 199 670 989 | 249 595 885 | 312 449 228 | 382 989 298 | 458 483 329 | 537 114 117 |
| **Current Assets** | **12 155 437 110** | **15 508 245 472** | **19 751 160 882** | **24 537 662 725** | **29 683 764 134** | **35 064 744 083** |
| - Inventories* | 1 042 742 891 | 1 219 293 099 | 1 343 921 170 | 1 424 058 366 | 1 479 987 954 | 1 519 563 860 |
| - Prepaid expenses and other current assets | 145 862 099 | 182 332 846 | 228 247 982 | 279 778 366 | 334 927 679 | 392 368 431 |
| - Deferred income taxes | 0 | 0 | 0 | 0 | 0 | 0 |
| - Accounts receivable, less allowances | 1 204 644 519 | 1 408 606 821 | 1 552 585 287 | 1 645 164 997 | 1 709 778 501 | 1 755 499 166 |
| - Marketable Securities | 3 494 633 178 | 3 931 893 447 | 4 423 865 193 | 4 977 394 101 | 5 600 182 409 | 6 300 896 088 |
| - Cash and cash equivalents | 6 267 554 424 | 8 766 119 258 | 12 202 541 249 | 16 211 266 896 | 20 558 887 591 | 25 096 416 540 |
| **Total assets** | **14 107 195 673** | **17 634 499 640** | **22 075 226 962** | **27 059 038 464** | **32 392 858 201** | **37 948 296 756** |
| - Common stock* | 1 000 000 | 1 000 000 | 1 000 000 | 1 000 000 | 1 000 000 | 1 000 000 |
| - Additional paid-in capital | 5 909 709 235 | 6 527 972 066 | 7 185 741 456 | 7 865 881 217 | 8 559 577 835 | 9 261 151 517 |
| - Treasury stock | -7 866 000 000 | -8 929 000 000 | -9 642 500 000 | -10 126 650 000 | -10 457 905 000 | -10 685 958 500 |
| - Accumulated other comprehensive income | -18 000 000 | -18 000 000 | -18 000 000 | -18 000 000 | -18 000 000 | -18 000 000 |
| - Retained earnings | 11 334 851 428 | 14 308 630 230 | 17 593 883 239 | 21 049 034 398 | 24 605 660 956 | 28 219 856 711 |
| **Shareholders' equity*** | **9 361 560 664** | **11 890 602 296** | **15 120 124 695** | **18 771 265 615** | **22 690 333 791** | **26 778 049 727** |
| **Non-current liabilities** | **3 437 505 717** | **4 279 444 114** | **5 367 547 756** | **6 604 044 022** | **7 933 379 897** | **9 323 834 627** |
| - Long-term debt | 3 213 391 838 | 4 088 466 811 | 5 204 807 588 | 6 465 365 960 | 7 815 206 215 | 9 223 133 630 |
| - Other long-term liabilities | 224 113 879 | 190 977 303 | 162 740 168 | 138 678 062 | 118 173 682 | 100 700 997 |
| **Current liabilities** | **1 308 129 293** | **1 464 453 229** | **1 587 554 512** | **1 683 728 827** | **1 769 144 513** | **1 846 412 402** |
| - Accounts payable | 718 948 084 | 840 675 535 | 926 603 824 | 981 856 642 | 1 020 418 852 | 1 047 705 561 |
| - Accrued and other current liabilities* | 578 181 209 | 616 777 694 | 657 950 688 | 701 872 185 | 748 725 661 | 798 706 841 |
| - Convertible short-term debt | 11 000 000 | 7 000 000 | 3 000 000 | 0 | 0 | 0 |
| **Total liabilities** | **4 745 635 010** | **5 743 897 343** | **6 955 102 268** | **8 287 772 849** | **9 702 524 410** | **11 170 247 029** |
| **Total liabilities, convertible debt conversion obligation and shareholders' equity** | **14 107 195 673** | **17 634 499 640** | **22 075 226 962** | **27 059 038 464** | **32 392 858 201** | **37 948 296 756** |

Source: Company data and Author estimates

## *Appendix 7: Common-Size Forecasted Statement of Financial Position*

| Common-Size Balance Sheet | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|
| **Non-Current Assets** | **22,43%** | **20,66%** | **17,87%** | **13,26%** | **17,67%** |
| - Property and equipment, net* | 8,04% | 7,74% | 6,32% | 5,29% | 8,87% |
| - Goodwill* | 8,87% | 8,58% | 8,39% | 6,28% | 5,50% |
| - Intangible Assets, net* | 4,08% | 3,08% | 2,25% | 1,06% | 0,46% |
| - Other Assets | 1,44% | 1,26% | 0,91% | 0,63% | 2,84% |
| **Current Assets** | **77,57%** | **79,34%** | **82,13%** | **86,74%** | **82,33%** |
| - Inventories* | 5,35% | 6,71% | 5,67% | 8,07% | 7,08% |
| - Prepaid expenses and other current assets | 0,97% | 0,97% | 1,26% | 1,20% | 0,77% |
| - Deferred income taxes | 0,95% | 0,88% | 0,00% | 0,00% | 0,00% |
| - Accounts receivable, less allowances | 5,88% | 6,58% | 6,85% | 8,39% | 11,25% |
| - Marketable Securities | 48,55% | 57,30% | 60,26% | 51,13% | 27,63% |
| - Cash and cash equivalents | 15,88% | 6,89% | 8,09% | 17,95% | 35,60% |
| **Total assets** | **100,00%** | **100,00%** | **100,00%** | **100,00%** | **100,00%** |
| - Common stock* | 0,01% | 0,01% | 0,01% | 0,01% | 0,01% |
| - Additional paid-in capital | 48,04% | 53,53% | 56,58% | 47,84% | 47,60% |
| - Treasury stock | -34,99% | -47,14% | -54,93% | -51,20% | -59,16% |
| - Accumulated other comprehensive income | 0,07% | 0,11% | -0,05% | -0,16% | -0,16% |
| - Retained earnings | 48,34% | 54,84% | 59,02% | 62,07% | 78,17% |
| **Shareholders' equity*** | **61,46%** | **61,35%** | **60,64%** | **58,55%** | **66,46%** |
| **Non-current liabilities** | **25,50%** | **26,21%** | **7,46%** | **23,28%** | **23,28%** |
| - Long-term debt | 18,95% | 19,42% | 1,32% | 20,53% | 17,66% |
| - Other long-term liabilities | 6,55% | 6,79% | 6,15% | 2,75% | 5,62% |
| **Current liabilities** | 13,04% | 12,44% | 31,90% | 18,17% | 10,26% |
| - Accounts payable | 4,47% | 4,07% | 4,02% | 4,93% | 5,30% |
| - Accrued and other current liabilities* | 8,57% | 8,37% | 8,71% | 5,15% | 4,82% |
| - Convertible short-term debt | 0,00% | 0,00% | 19,17% | 8,09% | 0,13% |
| **Total liabilities** | **38,54%** | **38,65%** | **39,36%** | **41,45%** | **33,54%** |
| **Total liabilities, convertible debt conversion obligation and shareholders' equity** | **100,00%** | **100,00%** | **100,00%** | **100,00%** | **100,00%** |

Source: Company data and Author estimates

## *Appendix 8: Cash Flow Statement*

| CONSOLIDATED STATEMENTS OF CASH FLOWS | FY2019E | FY2020E | FY2021E | FY2022E | FY2023E | FY2024E |
|---|---|---|---|---|---|---|
| **Cash from Operating Activities** | | | | | | |
| EBIT | 3 767 869 252 | 4 430 896 196 | 4 881 448 144 | 5 156 289 429 | 5 339 277 457 | 5 462 656 008 |
| Income tax | -259 591 973 | -302 988 274 | -334 723 329 | -352 033 677 | -362 372 663 | -368 238 194 |
| Financial income | 33 170 933 | 37 321 392 | 41 991 170 | 47 245 247 | 53 156 731 | 59 807 880 |
| Others | -4 351 800 | -4 351 800 | -4 351 800 | -4 351 800 | -4 351 800 | -4 351 800 |
| **- Adjustments to reconcile net income to net cash provided by operating activities:** | | | | | | |
| Depreciation and amortization | 284 315 334 | 307 377 014 | 341 139 991 | 377 718 437 | 412 077 387 | 442 494 058 |
| Stock based compensation | 437 115 616 | 511 125 090 | 563 368 914 | 596 962 257 | 620 407 822 | 636 997 958 |
| Tax benefit from stock-based compensation | 0 | 0 | 0 | 0 | 0 | 0 |
| Other non-current assets | 119 329 011 | -49 924 896 | -62 853 344 | -70 540 070 | -75 494 031 | -78 630 788 |
| **- Changes in operating assets and liabilities, net of effects of acquisitions:** | | | | | | |
| Changes in NWC | -87 120 216 | -256 659 322 | -187 420 390 | -125 072 974 | -90 276 719 | -65 469 434 |
| Change in Other long-term liabilities | -407 886 121 | -33 136 576 | -28 237 135 | -24 062 106 | -20 504 380 | -17 472 685 |
| **Net cash provided by operating activities** | **3 882 850 035** | **4 639 658 824** | **5 210 362 222** | **5 602 154 742** | **5 871 919 805** | **6 067 793 004** |
| **Cash flows from investing activities:** | | | | | | |
| Purchases of marketable securities | -2 306 266 256 | -2 594 834 055 | -2 919 508 429 | -3 284 807 153 | -3 695 813 284 | -4 158 245 886 |
| Proceeds from sales of marketable securities | 1 204 026 375 | 1 354 678 208 | 1 524 180 107 | 1 714 890 654 | 1 929 463 546 | 2 170 884 521 |
| Proceeds from maturities of marketable securities | 713 606 704 | 802 895 578 | 903 356 576 | 1 016 387 592 | 1 143 561 430 | 1 286 647 686 |
| Purchases of property and equipment and intangible assets | -369 402 908 | -431 947 723 | -476 098 560 | -504 488 025 | -524 301 685 | -538 321 876 |
| Other investing activities | 0 | 0 | 0 | 0 | 0 | 0 |
| **Net cash used in investing activities** | **-758 036 086** | **-869 207 992** | **-968 070 306** | **-1 058 016 933** | **-1 147 089 993** | **-1 239 035 554** |
| **Cash flows from financing activities:** | | | | | | |
| Payments related to repurchases of common stock | -910 000 000 | -910 000 000 | -637 000 000 | -445 900 000 | -312 130 000 | -218 491 000 |
| Dividends paid | -916 259 238 | -1 069 431 392 | -1 181 443 857 | -1 242 542 691 | -1 279 035 309 | -1 299 738 365 |
| Proceeds (payments) related to employee stock plans | 121 593 619 | 107 137 741 | 94 400 476 | 83 177 504 | 73 288 795 | 64 575 724 |
| Payments related to tax on restricted stock units | -306 000 000 | -153 000 000 | -76 500 000 | -38 250 000 | -19 125 000 | -9 562 500 |
| Financial expense | -72 985 745 | -117 667 320 | -117 667 320 | -149 455 348 | -190 047 858 | -235 939 775 |
| Loan payments | 1 224 391 838 | 871 074 973 | 1 112 340 777 | 1 257 558 372 | 1 349 840 256 | 1 407 927 415 |
| **Net cash provided by (used in) financing activities** | **-859 259 525** | **-1 271 885 998** | **-805 869 924** | **-535 412 163** | **-377 209 117** | **-291 228 501** |
| Change in cash and cash equivalents | 2 265 554 424 | 2 498 564 834 | 3 436 421 991 | 4 008 725 646 | 4 347 620 695 | 4 537 528 949 |
| Cash and cash equivalents at beginning of period | 4 002 000 000 | 6 267 554 424 | 8 766 119 258 | 12 202 541 249 | 16 211 266 896 | 20 558 887 591 |
| **Cash and cash equivalents at end of period** | **6 267 554 424** | **8 766 119 258** | **12 202 541 249** | **16 211 266 896** | **20 558 887 591** | **25 096 416 540** |

Source: Company data and Author estimates

## *Appendix 9: Historical Financial Ratios*

| Profitability Ratios | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|---|
| **Returns** | | | | | | |
| Return on Common Equity | % | 9,48 | 14,22 | 13,82 | 32,57 | 46,05 |
| Return on Assets (Net income/ Av Total Assets) | % | 6,44 | 8,73 | 8,43 | 19,36 | 28,91 |
| Return on Capital | % | 8,40 | 11,62 | 11,20 | 23,67 | 34,43 |
| **Margins** | | | | | | |
| Gross Margin | % | 60,70 | 60,23 | 60,04 | 61,51 | 61,98 |
| EBITDA Margin | % | 17,80 | 20,92 | 18,84 | 30,69 | 35,09 |
| Operating Margin | % | 17,80 | 20,92 | 18,84 | 30,69 | 35,09 |
| Net Income Margin | % | 10,65 | 13,48 | 12,26 | 24,11 | 31,37 |
| **Additional** | | | | | | |
| Dvd Payout Ratio | *times* | 41,23 | 29,47 | 34,69 | 15,67 | 11,19 |
| Sustainable Growth Rate | % | 5,57 | 10,03 | 9,02 | 27,47 | 40,90 |

| Capital Structure Ratios | | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|---|
| Total Debt to EBITDA | *times* | 1,41 | 1,17 | 1,33 | 1,22 | 0,55 |
| Interest Coverage Ratio (EBIT to Interest Expense) | *times* | 70,40 | 21,23 | 20,09 | 36,57 | 55,89 |
| Total Debt/Equity | *times* | 30,89 | 31,73 | 33,88 | 48,94 | 26,77 |
| Asset Turnover (Sales/ Av Total Assets) | *times* | 0,60 | 0,65 | 0,69 | 0,80 | 0,92 |
| Shareholder Equity Ratio | *times* | 0,61 | 0,61 | 0,61 | 0,59 | 0,66 |
| Non-current assets coverage | *times* | 3,88 | 4,24 | 3,81 | 6,17 | 5,08 |
| Times Interest Earnings | *times* | 70,40 | 21,23 | 20,09 | 36,57 | 55,89 |

| Liquidity Ratios | | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|---|
| Cash Ratio | *times* | 4,94 | 5,16 | 2,14 | 3,80 | 6,16 |
| Current Ratio | *times* | 5,95 | 6,38 | 2,57 | 4,77 | 8,03 |
| Quick Ratio | *times* | 5,39 | 5,69 | 2,36 | 4,26 | 7,26 |

| Efficiency Ratios | | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|---|
| | | **01/26/2014** | **01/25/2015** | **01/31/2016** | **01/29/2017** | **01/28/2018** |
| Accounts Receivable Turnover | *times* | 9,38 | 10,40 | 10,24 | 10,38 | 9,29 |
| Days Sales Outstanding (DSO) | *days* | 38,91 | 34,98 | 36,23 | 35,06 | 39,28 |
| Inventory Turnover | *times* | 4,65 | 4,28 | 4,44 | 4,39 | 4,65 |
| Days Inventory Outstanding (DIO) | *days* | 78,22 | 85,10 | 83,47 | 82,93 | 78,57 |
| Accounts Payable Turnover | *times* | 5,40 | 6,34 | 6,58 | 7,77 | 6,84 |
| Days Payable Outstanding (DPO) | *days* | 67,44 | 57,43 | 56,42 | 46,82 | 53,39 |
| Cash Conversion Cycle (CCC) | *days* | 49,69 | 62,65 | 63,28 | 71,16 | 64,47 |
| Inventory to Cash Days | *days* | 117,02 | 120,09 | 119,71 | 117,98 | 117,86 |

| Degrees of Leverage | | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|---|
| Degree of Operating Leverage | *times* | 5,05 | 3,71 | 4,03 | 2,20 | 1,88 |
| Degree of Financial Leverage | *times* | 1,02 | 1,06 | 1,07 | 1,03 | 1,02 |
| Degree of Combined Leverage | *times* | 5,16 | 3,95 | 4,30 | 2,27 | 1,91 |

Source: Company data and Author estimates

## *Appendix 10: Forecasted Financial Ratios*

| Profitability Ratios | *Units* | FY2019E | FY2020E | FY2021E | FY2022E | FY2023E | FY2024E |
|---|---|---|---|---|---|---|---|
| **Returns** | | | | | | | |
| Return on Common Equity | *%* | 41,16 | 38,05 | 33,07 | 27,72 | 23,33 | 19,87 |
| Return on Assets (Net income/ Av Total Assets) | *%* | 27,33 | 25,48 | 22,50 | 19,12 | 16,27 | 13,97 |
| Return on Capital | *%* | 32,07 | 29,12 | 25,25 | 21,28 | 18,03 | 15,49 |
| **Margins** | | | | | | | |
| Gross Margin | *%* | 60,89 | 60,89 | 60,89 | 60,89 | 60,89 | 60,89 |
| EBITDA Margin | *%* | 34,00 | 34,00 | 34,00 | 34,00 | 34,00 | 34,00 |
| Operating Margin | *%* | 34,00 | 34,00 | 34,00 | 34,00 | 34,00 | 34,00 |
| Net Income Margin | *%* | 29,07 | 29,01 | 29,08 | 28,86 | 28,59 | 28,29 |
| **Additional** | | | | | | | |
| Dvd Payout Ratio | *times* | 26,45 | 26,45 | 26,45 | 26,45 | 26,45 | 26,45 |
| Sustainable Growth Rate | *%* | 30,27 | 27,99 | 24,33 | 20,39 | 17,16 | 14,61 |
| **Capital Structure Ratios** | | **FY2019E** | **FY2020E** | **FY2021E** | **FY2022E** | **FY2023E** | **FY2024E** |
| Total Debt to EBITDA | *times* | 0,80 | 0,86 | 1,00 | 1,17 | 1,36 | 1,56 |
| Interest Coverage Ratio (EBIT to Interest Expense) | *times* | 55,52 | 40,27 | 44,38 | 37,03 | 30,26 | 25,03 |
| Total Debt/Equity | *times* | 34,44 | 34,44 | 34,44 | 34,44 | 34,44 | 34,44 |
| Asset Turnover (Sales/ Av Total Assets) | *times* | 0,94 | 0,88 | 0,77 | 0,66 | 0,57 | 0,49 |
| Shareholder Equity Ratio | *times* | 0,66 | 0,67 | 0,68 | 0,69 | 0,70 | 0,71 |
| Non-current assets coverage | *times* | 6,56 | 7,60 | 8,82 | 10,06 | 11,30 | 12,52 |
| Times Interest Earnings | *times* | 55,52 | 40,27 | 44,38 | 37,03 | 30,26 | 25,03 |
| **Liquidity Ratios** | | **FY2019E** | **FY2020E** | **FY2021E** | **FY2022E** | **FY2023E** | **FY2024E** |
| Cash Ratio | *times* | 6,16 | 6,16 | 6,16 | 6,16 | 6,16 | 6,16 |
| Current Ratio | *times* | 9,29 | 10,59 | 12,44 | 14,57 | 16,78 | 18,99 |
| Quick Ratio | *times* | 8,38 | 9,63 | 11,45 | 13,56 | 15,75 | 17,96 |
| **Efficiency Ratios** | | **FY2019E** | **FY2020E** | **FY2021E** | **FY2022E** | **FY2023E** | **FY2024E** |
| | | **01/28/2019** | **01/28/2020** | **01/28/2021** | **01/28/2022** | **01/28/2023** | **01/28/2024** |
| Accounts Receivable Turnover | *times* | 9,65 | 10,67 | 10,37 | 10,18 | 10,08 | 10,02 |
| Days Sales Outstanding (DSO) | *days* | 36,89 | 36,89 | 36,89 | 36,89 | 36,89 | 36,89 |
| Inventory Turnover | *times* | 5,07 | 4,82 | 4,69 | 4,60 | 4,56 | 4,53 |
| Days Inventory Outstanding (DIO) | *days* | 81,66 | 81,66 | 81,66 | 81,66 | 81,66 | 81,66 |
| Accounts Payable Turnover | *times* | 7,46 | 7,22 | 6,94 | 6,75 | 6,66 | 6,61 |
| Days Payable Outstanding (DPO) | *days* | 56,30 | 56,30 | 56,30 | 56,30 | 56,30 | 56,30 |
| Cash Conversion Cycle (CCC) | *days* | 62,25 | 62,25 | 62,25 | 62,25 | 62,25 | 62,25 |
| Inventory to Cash Days | *days* | 118,55 | 118,55 | 118,55 | 118,55 | 118,55 | 118,55 |
| **Degrees of Leverage** | | **FY2019E** | **FY2020E** | **FY2021E** | **FY2022E** | **FY2023E** | **FY2024E** |
| Degree of Operating Leverage | *times* | 1,93 | 1,92 | 1,92 | 1,92 | 1,93 | 1,94 |
| Degree of Financial Leverage | *times* | 1,02 | 1,03 | 1,02 | 1,03 | 1,04 | 1,05 |
| Degree of Combined Leverage | *times* | 1,96 | 1,97 | 1,96 | 1,98 | 2,00 | 2,02 |

Source: Company data and Author estimates

| | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | FY2019E | FY2020E | FY2021E | FY2022E | FY2023E | FY2024E |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tax burden | 86,23% | 83,55% | 82,64% | 87,45% | 95,34% | 93,03% | 93,03% | 93,03% | 93,03% | 93,03% | 93,03% |
| Interest burden | 97,99% | 94,24% | 94,05% | 97,05% | 98,13% | 98,08% | 97,36% | 97,61% | 97,13% | 96,47% | 95,72% |
| Operating margin | 12,60% | 17,12% | 15,77% | 28,41% | 33,53% | 31,86% | 32,03% | 32,03% | 31,94% | 31,85% | 31,77% |
| Asset turnover | 0,60 | 0,65 | 0,69 | 0,80 | 0,92 | 0,94 | 0,88 | 0,77 | 0,66 | 0,57 | 0,49 |
| Leverage ratio | 1,63 | 1,63 | 1,64 | 1,68 | 1,59 | 1,51 | 1,49 | 1,47 | 1,45 | 1,43 | 1,42 |
| **ROE** | **0,10** | **0,14** | **0,14** | **0,33** | **0,46** | **0,41** | **0,38** | **0,33** | **0,28** | **0,23** | **0,20** |

Source: Company data and Author estimates

## *Appendix 11: Peers Cash Conversion Cycle*

| AMD | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|
| Days Sales Outstanding (DSO) | 27,45 | 54,54 | 62,79 | 35,96 | 24,35 |
| Days Inventory Outstanding (DIO) | 90,65 | 77,87 | 86,86 | 79,44 | 77,56 |
| Days Payable Outstanding (DPO) | 44,99 | 49,02 | 44,33 | 39,10 | 41,52 |
| Cash Conversion Cycle (CCC) | 73,11 | 83,40 | 105,32 | 76,30 | 60,38 |
| **Intel** | **FY2014** | **FY2015** | **FY2016** | **FY2017** | **FY2018** |
| Days Sales Outstanding (DSO) | 25,67 | 26,09 | 30,88 | 29,04 | 29,94 |
| Days Inventory Outstanding (DIO) | 76,71 | 75,86 | 84,69 | 84,11 | 96,57 |
| Days Payable Outstanding (DPO) | 53,02 | 51,10 | 41,37 | 35,02 | 39,25 |
| Cash Conversion Cycle (CCC) | 49,37 | 50,85 | 74,20 | 78,13 | 87,26 |
| **Xilinx Inc** | **FY2014** | **FY2015** | **FY2016** | **FY2017** | **FY2018** |
| Days Sales Outstanding (DSO) | 37,36 | 37,96 | 40,19 | 45,38 | 42,81 |
| Days Inventory Outstanding (DIO) | 116,38 | 106,55 | 121,66 | 111,04 | 104,65 |
| Days Payable Outstanding (DPO) | 26,91 | 34,45 | 36,34 | 53,43 | 50,69 |
| Cash Conversion Cycle (CCC) | 126,83 | 110,06 | 125,51 | 102,99 | 96,77 |
| **Broadcom Ltd.** | **FY2014** | **FY2015** | **FY2016** | **FY2017** | **FY2018** |
| Days Sales Outstanding (DSO) | 54,97 | 51,16 | 48,96 | 43,99 | 48,65 |
| Days Inventory Outstanding (DIO) | 66,13 | 61,17 | 58,03 | 47,97 | 56,93 |
| Days Payable Outstanding (DPO) | 67,94 | 54,96 | 64,10 | 41,80 | 47,07 |
| Cash Conversion Cycle (CCC) | 53,16 | 57,37 | 42,89 | 50,15 | 58,52 |
| **Texas Instruments Incorporated** | **FY2014** | **FY2015** | **FY2016** | **FY2017** | **FY2018** |
| Days Sales Outstanding (DSO) | 36,38 | 34,17 | 34,40 | 51,85 | 46,92 |
| Days Inventory Outstanding (DIO) | 108,98 | 113,87 | 116,58 | 123,91 | 127,89 |
| Days Payable Outstanding (DPO) | 27,18 | 27,57 | 28,63 | 27,31 | 28,53 |
| Cash Conversion Cycle (CCC) | 118,18 | 120,47 | 122,35 | 148,45 | 146,28 |
| **Peer's Average** | **FY2014** | **FY2015** | **FY2016** | **FY2017** | **FY2018** |
| Days Sales Outstanding (DSO) | 36,37 | 40,78 | 43,44 | 41,24 | 38,53 |
| Days Inventory Outstanding (DIO) | 91,77 | 87,07 | 93,56 | 89,29 | 92,72 |
| Days Payable Outstanding (DPO) | 44,01 | 43,42 | 42,96 | 39,33 | 41,41 |
| Cash Conversion Cycle (CCC) | 84,13 | 84,43 | 94,05 | 91,21 | 89,84 |

Source: Companies data and Author calculations

| | FY2014 | | FY2015 | | FY2016 | | FY2017 | | FY2018 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | NVIDIA | Peer's | NVIDIA | Peer's | NVIDIA | Peer's | NVIDIA | Peer's | NVIDIA | Peer's |
| Days Sales Outstanding (DSO) | 38,91 | 36,37 | 34,98 | 40,78 | 36,23 | 43,44 | 35,06 | 41,24 | 39,28 | 38,53 |
| Days Inventory Outstanding (DIO) | 78,22 | 91,77 | 85,10 | 87,07 | 83,47 | 93,56 | 82,93 | 89,29 | 78,57 | 92,72 |
| Days Payable Outstanding (DPO) | 67,44 | 44,01 | 57,43 | 43,42 | 56,42 | 42,96 | 46,82 | 39,33 | 53,39 | 41,41 |
| Cash Conversion Cycle (CCC) | 117,02 | 84,13 | 62,65 | 84,43 | 63,28 | 94,05 | 71,16 | 91,21 | 64,47 | 89,84 |

Source: Companies data and Author calculations

## *Appendix 12: Peers Degrees of Leverage*

| DOL | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|
| AMD | 19,20 | -11,86 | -2,25 | -2,68 | 8,94 |
| Intel Corporation | 2,56 | 2,32 | 2,48 | 2,81 | 2,18 |
| Xilinx, Inc | 2,46 | 2,19 | 2,21 | 2,30 | 2,35 |
| Broadcom Ltd. | 2,17 | 4,29 | 2,18 | -14,52 | 3,57 |
| Texas Instruments Incorporated | 2,25 | 1,88 | 1,77 | 1,70 | 1,58 |
| **Peers Average** | **5,73** | **-0,24** | **1,28** | **-2,08** | **3,72** |
| **NVIDIA** | **5,05** | **3,71** | **4,03** | **2,20** | **1,88** |

| DFL | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|
| AMD | -1,39 | 0,47 | 0,75 | 0,70 | 2,62 |
| Intel Corporation | 1,02 | 1,01 | 1,02 | 1,06 | 1,04 |
| Xilinx, Inc | 1,06 | 1,04 | 1,02 | 1,05 | 1,01 |
| Broadcom Ltd. | 1,00 | 1,34 | 1,13 | 0,41 | 1,24 |
| Texas Instruments Incorporated | 1,03 | 1,02 | 1,02 | 1,02 | 1,01 |
| **Peers Average** | **0,55** | **0,98** | **0,99** | **0,85** | **1,38** |
| **NVIDIA** | **1,02** | **1,06** | **1,07** | **1,03** | **1,02** |

| DCL | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|
| AMD | -26,73 | -5,54 | -1,68 | -1,89 | 23,37 |
| Intel Corporation | 2,62 | 2,35 | 2,54 | 2,98 | 2,26 |
| Xilinx, Inc | 2,62 | 2,28 | 2,25 | 2,42 | 2,37 |
| Broadcom Ltd. | 2,18 | 5,72 | 2,47 | -5,98 | 4,41 |
| Texas Instruments Incorporated | 2,33 | 1,93 | 1,81 | 1,73 | 1,60 |
| **Peers Average** | **3,13** | **-0,23** | **1,26** | **-1,76** | **5,15** |
| **NVIDIA** | **5,16** | **3,95** | **4,30** | **2,27** | **1,91** |

Source: Companies data and Author calculations

## *Appendix 13: Peers Financial Ratios*

| Shareholder Equity Ratio | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|
| AMD | 0,13 | 0,05 | -0,13 | 0,13 | 0,17 |
| Intel Corporation | 0,65 | 0,62 | 0,60 | 0,58 | 0,56 |
| Xilinx, Inc | 0,63 | 0,55 | 0,53 | 0,55 | 0,53 |
| Broadcom Ltd. | 0,45 | 0,31 | 0,45 | 0,44 | 0,43 |
| Texas Instruments Incorporated | 0,57 | 0,60 | 0,61 | 0,64 | 0,59 |
| **Peers Average** | **0,48** | **0,42** | **0,41** | **0,47** | **0,45** |
| **NVIDIA** | **0,60** | **0,65** | **0,69** | **0,80** | **0,92** |

| Non-current assets coverage | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|
| AMD | 1,48 | 1,48 | 1,49 | 1,58 | 1,70 |
| Intel Corporation | 1,31 | 1,18 | 1,39 | 1,20 | 1,13 |
| Xilinx, Inc | 1,79 | 2,05 | 4,09 | 4,29 | 4,47 |
| Broadcom Ltd. | 1,88 | 1,42 | 1,40 | 1,09 | 1,34 |
| Texas Instruments Incorporated | 1,48 | 1,48 | 1,49 | 1,58 | 1,73 |
| **Peers Average** | **1,59** | **1,52** | **1,97** | **1,95** | **2,07** |
| **NVIDIA** | **3,88** | **4,24** | **3,81** | **6,17** | **5,08** |

| Times Interest Earnings | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 |
|---|---|---|---|---|---|
| AMD | 0,58 | -0,88 | -3,01 | -2,38 | 1,62 |
| Intel Corporation | 26,10 | 37,34 | 41,55 | 17,56 | 27,76 |
| Xilinx, Inc | 17,22 | 25,34 | 50,33 | 20,27 | 84,12 |
| Broadcom Ltd. | 276,00 | 3,98 | 8,54 | -0,70 | 4,37 |
| Texas Instruments Incorporated | 30,76 | 42,59 | 48,13 | 60,69 | 77,99 |
| **Peers Average** | **70,13** | **21,67** | **29,11** | **19,09** | **39,17** |
| **NVIDIA** | **70,40** | **21,23** | **20,09** | **36,57** | **55,89** |

Source: Companies data and Author calculations

| | NVIDIA | AMD | Intel | Xilinx, Inc | Broadcom Ltd. | T.I | Peers average | NVIDIA 2019 | NVIDIA 2024 |
|---|---|---|---|---|---|---|---|---|---|
| Tax burden | 0,95 | 0,62 | 0,47 | 0,68 | 0,93 | 0,60 | 0,66 | 0,95 | 0,93 |
| Interest burden | 0,98 | 0,37 | 0,97 | 0,94 | 0,80 | 0,99 | 0,81 | 0,98 | 0,96 |
| Operating margin | 0,34 | 0,35 | 0,33 | 0,31 | 0,13 | 0,41 | 0,31 | 0,32 | 0,32 |
| Asset turnover | 0,92 | 0,16 | 0,53 | 0,52 | 0,34 | 0,88 | 0,49 | 0,88 | 0,49 |
| Leverage ratio | 1,59 | 6,68 | 1,73 | 2,02 | 2,66 | 1,64 | 2,95 | 1,59 | 1,43 |
| **ROE** | **0,46** | **0,08** | **0,14** | **0,21** | **0,09** | **0,35** | **0,17** | **0,42** | **0,20** |

Source: Companies data and Author calculations

| | NVIDIA | AMD | Intel | Xilinx, Inc | Broadcom Ltd. | T.I | Peers average |
|---|---|---|---|---|---|---|---|
| Cash Ratio | 6,16 | 0,79 | 0,30 | 3,07 | 4,35 | 1,98 | 2,10 |
| Current Ratio | 8,03 | 1,76 | 1,69 | 4,32 | 6,22 | 3,87 | 3,57 |
| Quick Ratio | 7,26 | 1,07 | 4,48 | 3,70 | 5,32 | 2,54 | 3,42 |

Source: Companies data and Author calculations

## *Appendix 14: Forecasting Assumptions (numbers in $millions)*

| Statement of Income | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | Average | FY2020E | FY2021E | FY2022E | FY2023E | FY2023E | FY2024E | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total Revenue** | | | **12,54%** | **6,77%** | **32,15%** | **34,06%** | **21,38%** | **22,68%** | **16,93%** | **10,22%** | **5,96%** | **3,93%** | **2,67%** | Refer to section 5. "Valuation" for a discussion of assumption taken to forecast revenues |
| Gaming | YoY growth rate | | 30,90% | 31,43% | 36,52% | 30,59% | 32,36% | 24,09% | 18,09% | 12,09% | 6,09% | 4,09% | 2,09% | |
| Professional Visualization | YoY growth rate | | 0,76% | -5,83% | 10,74% | 11,20% | 4,22% | 4,22% | 2,22% | 1,22% | 0,22% | 2,22% | 3,02% | |
| Data Center | YoY growth rate | | 46,56% | 6,71% | 89,54% | 84,49% | 56,83% | 41,83% | 26,83% | 11,83% | 8,83% | 4,83% | 4,33% | |
| Automotive | YoY growth rate | | 61,44% | 55,88% | 41,99% | 13,61% | 43,23% | 5,00% | 4,00% | 4,00% | 3,00% | 3,00% | 3,00% | |
| OEM & IP | YoY growth rate | | -14,21% | -52,90% | -11,49% | 10,72% | -16,97% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | |
| **Gross margin percentage** | **%** | **60,70%** | **60,23%** | **60,04%** | **61,51%** | **61,98%** | **60,89%** | **60,89%** | **60,89%** | **60,89%** | **60,89%** | **60,89%** | **60,89%** | |
| R&D to sales | % of total sales | 32,34% | 29,04% | 26,57% | 21,17% | 18,50% | | 18,50% | 18,50% | 18,50% | 18,50% | 18,50% | 18,50% | Equal to % of total sales of 2018, since R&D % of total sales is decreasing since 2014 |
| SG&A to sales | % of total sales | 10,55% | 10,27% | 12,02% | 9,59% | 8,39% | | 8,39% | 8,39% | 8,39% | 8,39% | 8,39% | 8,39% | Equal to % of total sales of 2018, since SG&A % of total sales is decreasing since 2014 |
| R&OC to sales | % of total sales | 0,00% | 0,00% | 2,61% | 0,04% | 0,00% | | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | Equal to 2018 value |
| Implicit marginal tax rate (t) | | 0,00% | 22,01% | 38,54% | 9,47% | 6,97% | | 6,97% | 6,97% | 6,97% | 6,97% | 6,97% | 6,97% | Equal to 2018 marginal tax rate |
| **Other comprehensive income (loss), net of tax* (thousands)** | | **-5** | **3** | **-12** | **-12** | **-2** | | **-2** | **-2** | **-2** | **-2** | **-2** | **-2** | This is composed by unrealized gains on available-for-sale securities and cash flow hedges. This value will be equal to 2018 value |

| Balance Sheet | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | Average | FY2020E | FY2021E | FY2022E | FY2023E | FY2023E | FY2024E | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Non-Current Assets** | | | | | | | | | | | | | | |
| - Goodwill* | YoY | | -3,96% | -0,03% | 0,00% | 0,00% | | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | There are not expectations of acquisition of new business or impairments |
| - Other Assets | % of total assets | 1,44% | 1,26% | 0,91% | 0,63% | 2,84% | 1,42% | 1,42% | 1,42% | 1,42% | 1,42% | 1,42% | 1,42% | Based in a 5-year historical average of other non-current assets to total assets ratio |
| **Current Assets** | | | | | | | | | | | | | | |
| - Inventories* | DIO (days) | 78,22 | 85,10 | 83,47 | 82,93 | 78,57 | 81,66 | 81,66 | 81,66 | 81,66 | 81,66 | 81,66 | 81,66 | Based in a DIO 5-year historical average |
| - Prepaid expenses and other current assets | % of total assets | 0,97% | 0,97% | 1,26% | 1,20% | 0,77% | 1,03% | 1,03% | 1,03% | 1,03% | 1,03% | 1,03% | 1,03% | Based in a 5-year historical average of prepaid expenses and other current assets to total assets ratio |
| - Deferred income taxes | % of total sales | 1,66% | 1,35% | 0,00% | 0,00% | 0,00% | | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | Equal to 2018 nominal value |
| - Accounts receivable, less allowances | DSO (days) | 38,91 | 34,98 | 36,23 | 35,06 | 39,28 | 36,89 | 36,89 | 36,89 | 36,89 | 36,89 | 36,89 | 36,89 | Based in a DSO 5-year historical average |
| - Accumulated other comprehensive income (thousands) | $ | 5 | 8 | -4 | -16 | -18 | | -18 | -18 | -18 | -18 | -18 | -18 | Equal to 2018 nominal value |
| **Current liabilities** | | | | | | | | | | | | | | |
| - Accounts payable | A/P turnover (x) | 67,44 | 57,43 | 56,42 | 46,82 | 53,39 | 56,30 | 56,30 | 56,30 | 56,30 | 56,30 | 56,30 | 56,30 | Based in an A/P turnover 5-year historical average |
| - Total accrued liabilities and other | YoY | | -2,99% | 6,30% | -23,61% | 6,68% | | 6,68% | 6,68% | 6,68% | 6,68% | 6,68% | 6,68% | Up until FY2017, Total Accrued Liabilities and other, was mainly composed by deferred revenue, where was included the cross-licensing agreement with Intel Corporation that expired in FY2017 and gave rise to the abnormal variation in that year. Considering this we assumed FY2017 variation as a one-time event, we considered the FY2018 growth as assumption for the next years |
| **Non-current liabilities** | | | | | | | | | | | | | | |
| - Other Long-Term Liabilities | YoY | | 2,86% | -7,63% | -51,38% | -3,00% | -14,79% | -14,79% | -14,79% | -14,79% | -14,79% | -14,79% | -14,79% | Other long-term liabilities are mainly composed by income tax payable, deferred income tax liability and deferred revenue. Income tax payable has a long-term portion of the one-time transition tax payable of $369 million, that we considered one-time event and was excluded in the computation of the 5-year historical average |

| Capital Expenditures | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | Average | FY2020E | FY2021E | FY2022E | FY2023E | FY2023E | FY2024E | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capex | YoY | 6,18% | 2,61% | 1,72% | 2,55% | 2,45% | 3,10% | 3,10% | 3,10% | 3,10% | 3,10% | 3,10% | 3,10% | Based on a 5-year YoY historical average |
| **Capital Expenditures** | **$** | **255,2** | **122** | **86** | **176** | **238** | | **369,4** | **431,9** | **476,1** | **504,5** | **524,3** | **538,3** | For the calculation of Cap. Ex, we took out the building value in FY2018 that is considered one-time event |

| Depreciation and Amortization | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | Average | FY2020E | FY2021E | FY2022E | FY2023E | FY2023E | FY2024E | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Depreciation and Amortization expenses | $ | 239,1 | 220 | 197 | 187 | 199 | | 284,3 | 307,3 | 341,1 | 377,7 | 412,1 | 442,5 | 5-year average of total D&A to PP&E racio times PP&E of the current year |
| Amortization expenses | $ | 73 | 77 | 73 | 68 | 55 | | 26 | 17 | 8 | 1 | 0 | 0 | Disclosed at 2018 Financial Report |
| Depreciation expenses | $ | 166,1 | 143 | 124 | 119 | 144 | | 258,3 | 290,4 | 333,1 | 376,7 | 412,1 | 442,5 | Since the amount of amortization is disclosed, the amount of depreciation is Total A&D minus amortization |
| **Total property and equipment, net** | **$** | **582,7** | **557,3** | **466** | **521** | **997** | | **1 108,1** | **1 249,7** | **1 392,6** | **1 520,4** | **1 632,6** | **1 728,4** | |
| Gross Carrying Amount | | 635,4 | 638,1 | 655 | 661 | 664 | | 664 | 664 | 664 | 664 | 664 | 664 | Equal to 2018 nominal value, since the amount of Intangible Assets were constant in the last years and there is not information of significant acquisition in the future |
| Accumulated Amortization | | 339,4 | 416,4 | 489 | 557 | 612 | | 638 | 655 | 663 | 664 | 664 | 664 | |
| **Total intangible assets, net** | **$** | **296** | **221,7** | **166** | **104** | **52** | | **26** | **9** | **1** | **0** | **0** | **0** | |
| Dep & amort exp to total PPE&IA | % | 27,21% | 28,24% | 31,17% | 29,92% | 18,97% | 27,10% | 27,10% | 27,10% | 27,10% | 27,10% | 27,10% | 27,10% | Based on a 5-year historical average of dep & amort exp to total PPE&IA ratio |

| Marketable Securities | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | Average | FY2020E | FY2021E | FY2022E | FY2023E | FY2023E | FY2024E | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total marketable securities** | **$** | **3 52,2** | **4 12,7** | **4 441** | **5 032** | **3 106** | | **3 494,6** | **3 931,9** | **4 423,9** | **4 977,4** | **5 600,2** | **6 300,9** | We considered that the future value of marketable securities will be the prior value of marketable securities plus the expected purchase of securities minus the expected sales of securities minus the expected due of securities |
| Purchases of marketable securities | % of Total Marketable S. | 87,08% | 69,35% | 78,29% | 62,28% | 1,16% | 74,252% | 2 306,3 | 2 594,8 | 2 919,5 | 3 284,8 | 3 695,8 | 4 158,2 | Comparing the past values of securities purchases, we considered that the 2018 value is a one-time event |
| Proceeds from sales of marketable securities | % of Total Marketable S. | -54,74% | -33,25% | -47,33% | -30,72% | -27,78% | -38,765% | -1 204 026 375 | -1 354 678 208 | -1 524 180 107 | -1 714 890 654 | -1 929 463 546 | -2 170 884 521 | |
| Proceeds from maturities of marketable securities | % of Total Marketable S. | -16,62% | -20,96% | -23,33% | -19,26% | -34,71% | -22,975% | -713 606 704 | -802 895 578 | -903 356 576 | -1 016 387 592 | -1 143 561 430 | -1 286 647 686 | |

| Debt | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | Average | FY2020E | FY2021E | FY2022E | FY2023E | FY2023E | FY2024E | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Short term debt** | **$** | **2,9** | **3,4** | **1 417** | **800** | **15** | | **11** | **7** | **3** | **0** | **0** | **0** | |
| Capital lease in other current liabilities | $ | 2,9 | 3,4 | 4 | 4 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | Equal to 2018 nominal value |
| Convertible debt | $ | 0 | 0 | 1 413 | 796 | 15 | | 11 | 7 | 3 | 0 | 0 | 0 | There is only convertible short-term debt if the price of our common stock was greater than or equal to 130% of the conversion price for at least 20 trading days during the 30 consecutive trading days. We assumed that this will not happen in the next years. In the first quarter report of 2019 there is a decrease of one million in convertible debt. We assume that this decrease will happen each quarter with a total of 4 million in each year |
| Total Debt | $ | 1 376,8 | 1 401,8 | 1 514 | 2 820 | 2 000 | | 3 224,4 | 4 095,5 | 5 207,8 | 6 465,4 | 7 815,2 | 9 223,1 | Total debt based in the current year debt to equity ratio and prior total shareholder's equity year |
| **Long-term debt** | **$** | **1 373,9** | **1 398,4** | **97** | **2 020** | **1 985** | | **3 213,4** | **4 088,5** | **5 204,8** | **6 465,4** | **7 815,2** | **9 223,1** | |
| **Total Debt** | | **1 376,8** | **1 401,8** | **1 514** | **2 820** | **2 000** | | **3 224,4** | **4 095,5** | **5 207,8** | **6 465,4** | **7 815,2** | **9 223,1** | |
| **Debt to Equity** | **(x)** | **0,31** | **0,32** | **0,34** | **0,49** | **0,27** | **0,34** | **0,34** | **0,34** | **0,34** | **0,34** | **0,34** | **0,34** | We assume a constant debt to equity for the next years |

| Common stock and additional paid-in capital | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | Average | FY2020E | FY2021E | FY2022E | FY2023E | FY2023E | FY2024E | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Common stock and additional paid-in capital** | **$** | **3 484,1** | **3 855,8** | **4 171** | **4 709** | **5 352** | | **5 910,7** | **6 529** | **7 186,7** | **7 866,9** | **8 560,6** | **9 262,2** | |
| Common stock | $ | 0,73 | 0,75 | 0,1 | 0,1 | 0,1 | | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | Equal to 2018 nominal value |
| Additional paid-in capital | % | | | | | | | 5 909,8 | 6 528 | 7 185,7 | 7 865,9 | 8 560 | 9 261,2 | |
| Stock-based compensation (SBC) | $ | 136 | 158 | 204 | 247 | 391 | | 437,1 | 511,1 | 563,4 | 5970 | 620,4 | 6370 | |
| Stock-based compensation as % of sales | % | 3,29% | 3,37% | 4,07% | 3,57% | 4,03% | 3,67% | 3,67% | 3,67% | 3,67% | 3,67% | 3,67% | 3,67% | Based on a 5-year historical average |
| Tax benefit from stock-based compensation | $ | 25,8 | 18 | 10 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | |
| Tax benefit from stock-based compensation as % of SBC | % | 18,97% | 11,39% | 4,90% | 0,00% | 0,00% | 7,05% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | Equal to 2018 nominal value |
| Issuance of common stock from stock plans | YoY and $ | | | -5,82% | -10,78% | -19,07% | -11,89% | 121,6 | 107,1 | 94,4 | 83,1 | 73,3 | 64,6 | Based in a 5 year over year historical average |

| Additional Paid-in | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | Average | FY2020E | FY2021E | FY2022E | FY2023E | FY2023E | FY2024E | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Balance t-1 | $ | 3 193,4 | 3 483,3 | 3 855 | 4 170 | 4 708 | | 5 351 | 5 909,7 | 6 528 | 7 185,7 | 7 865,9 | 8 559,6 | |
| Issuance of common stock from stock plans | $ | 97,4 | 197,1 | 186 | 167 | 138 | -11,89% | 121,6 | 107,1 | 94,4 | 83,2 | 73,3 | 64,6 | Based in a year over year 5-year historical average. |
| Stock-based compensation | $ | 136,2 | 156 | 206 | 248 | 391 | | 437,1 | 511,1 | 563,4 | 5970 | 620,4 | 6370 | |
| **Total** | **$** | **3 483,3** | **3 855,1** | **4 170** | **4 708** | **5 351** | | **5 909,7** | **6 528** | **7 185,7** | **7 865,9** | **8 559,6** | **9 261,2** | |

| Retained earnings | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | Average | FY2020E | FY2021E | FY2022E | FY2023E | FY2023E | FY2024E | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Retained earnings** | **$** | **3 504,8** | **3 948,9** | **4 350** | **6 108** | **8 787** | | **11 334,9** | **14 308,6** | **17 593,9** | **21 049** | **24 605,7** | **28 219,9** | |
| Dividends paid | $ | 181,3 | 186 | 213 | 261 | 341 000 000 | | 916,3 | 1 069,4 | 1 181,4 | 1 242,5 | 1 279 | 1 299,7 | Dividends paid = Number of shares outstanding * dividend amount per share |
| Dividend amount per share | $ | 0,33 | 0,34 | 0,39 | 0,44 | 0,56 | | 1,503 | 1,744 | 1,906 | 1,978 | 2,004 | 2,001 | |
| Total comprehensive income | $ | 439,8 | 631,1 | 614 | 1 666 | 3 047 | | 3 464,1 | 4 043,2 | 4 466,7 | 4 697,7 | 4 835,7 | 4 913,9 | |
| Pay-out Ratio | | 0,412 | 0,295 | 0,347 | 0,157 | 0,112 | 0,265 | 0,265 | 0,265 | 0,265 | 0,265 | 0,265 | 0,265 | We assume a constant pay-out ratio based in a 5-year historical average |
| Retained earnings adjustment due to adoption of an accounting standard related to income tax consequences of an intra-entity transfer of an asset | $ | | | | 353 | -27 | | 0 | 0 | 0 | 0 | 0 | 0 | Being this adjustment due to a adaptation of an accounting standard, we assumed this item as a one-time event in 2017 with residual value in 2018 |

| Total other income (expense), net | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | Average | FY2020E | FY2021E | FY2022E | FY2023E | FY2023E | FY2024E | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Interest income** | **$** | **17,2** | **28,1** | **39** | **54** | **69** | | **33,2** | **37,3** | **42** | **47,2** | **53,2** | **59,8** | Interest income as investment income to total investments 5-year average ratio times total investments of the prior year |
| Total investments | $ | 3 520,2 | 4 126,7 | 4 441 | 5 032 | 3 106 | | 3 494,6 | 3 931,9 | 4 423,9 | 4 977,4 | 5 600,2 | 6 300,9 | Total investments composed by marketable securities |
| Investment income as % of total investments | % | 0,49% | 0,68% | 0,88% | 1,07% | 2,22% | 1,07% | 1,07% | 1,07% | 1,07% | 1,07% | 1,07% | 1,07% | Based on a 5-year historical average |
| **Interest expenses** | **$** | **10,4** | **46,1** | **47** | **58** | **61** | | **73** | **117,7** | **117,7** | **149,5** | **190** | **235,9** | Interest expenses as cost of debt times total debt of the prior year |
| Total debt | $ | 1 376,8 | 1 401,8 | 1 514 | 2 820 | 2 000 | | 3 224,4 | 3 224,4 | 4 095,5 | 5 207,8 | 6 465,4 | 7 815,2 | |
| Cost of debt | % | | | | | | | 3,65% | 3,65% | 3,65% | 3,65% | 3,65% | 3,65% | Computed in DCFF calculations |
| Other income (expense), net | $ | 7,4 | 13,9 | 4 | -25 | -22 | -4,4 | -4,4 | -4,4 | -4,4 | -4,4 | -4,4 | -4,4 | Based on a 5-year historical average |

| Treasury stock | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | Average | FY2020E | FY2021E | FY2022E | FY2023E | FY2023E | FY2024E | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| - Balance t-1 | $ | -1 622,7 | -2 537,3 | -3 394,6 | -4 047,6 | -5 038,6 | | -6 650 0 | -7 866 | -8 929 | -9 642 | -10 126,7 | -10 457,9 | |
| Tax withholding related to vesting of restricted stock units | $ | -27,2 | -43,7 | -66 | -177 | -612 | | -306 | -153 | -76,5 | -38,3 | -19,1 | -9,6 | Since we do not have disclosed information about the vesting condition of restricted stock units and assuming the 124% variation on tax in 2018 was a one-time event, the tax whithold in the future will decrease in future years |
| Share repurchase | $ | -887,3 | -813,6 | -587 | -739 | -909 | | -910 0 | -910 | -637 | -445,9 | -312,1 | -218 ,5 | |
| Exercise of convertible note hedges | $ | 0 | 0 | 0 | -75 | -90 | | 0 | 0 | 0 | 0 | 0 | 0 | Equal to 2018 nominal value |
| **Total** | **$** | **-2 537,3** | **-3 394,6** | **-4 047,6** | **-5 038,6** | **-6 649,6** | | **-7 866** | **-8 929** | **-9 642,5** | **-10 126,7** | **-10 457,9** | **-10 686** | |

| Share Count Analysis | *Units* | FY2014 | FY2015 | FY2016 | FY2017 | FY2018 | Average | FY2020E | FY2021E | FY2022E | FY2023E | FY2023E | FY2024E | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Share repurchase: amount in the period | # | | 44,4 | 25 | 15 | 6 | | 6 | 6 | 4,2 | 2,9 | 2 | 1,4 | Amount of share repurchase = Share Repurchase / Price |
| Shares repurchase | $ | 887,3 | 814 | 587 | 739 | 909 | | 910 | 910 | 637 | 445,9 | 312 | 218,5 | As of January 28, 2018, Nvidia was authorized, subject to certain specifications, to repurchase additional shares of their common stock up to $1.82 billion through December 2020. We assume that this repurchase will be split equally through 2019 and 2020. For the next years the number of shares repurchased will decrease |
| Share repurchase: Price | $ | | 18,33 | 23,48 | 49,27 | 151,50 | | 152 | 152 | 152 | 152 | 152 | 152 | Equal to 2018 price |
| **Number of shares outstanding** | **#** | **557,3** | **553,2** | **544,5** | **594,5** | **607** | | **609,6** | **613,3** | **619,7** | **628,2** | **638,3** | **649,5** | Number of shares outstanding = Number of shares outstanding t-1 + new shares outstanding - repurchase of shares - equity awards outstanding - number of shares issued by the impact of convertible debt |
| Number of shares outstanding | YoY growth | | -0,74% | -1,57% | 8,78% | 2,08% | 2,14% | | | | | | | |
| New shares outstanding | # | | | | | | | 13 | 13 | 13,1 | 13,2 | 13,4 | 13,6 | |
| Equity awards granted (stock options RSUs and PSUs) | # | 16,9 | 13 | 13 | 12 | 6 | | 4,4 | 3,3 | 2,4 | 1,8 | 1,3 | 0,99 | |
| Equity awards granted (stock options RSUs and PSUs) | YoY growth | | -26,29% | 0,02% | -8,00% | -69,31% | -25,90% | -25,90% | -25,90% | -25,90% | -25,90% | -25,90% | -25,90% | Based on a 5-year historical average |
| Number of shares issued by the impact of convertible debt | # | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | There will be not conversion of debt in the next years |

## *Appendix 15: Discounted Cash Flow Valuation*

| Weighted Average Cost of Capital (WACC) | | | | | | |
|---|---|---|---|---|---|---|
| | 2019E | 2020E | 2021E | 2022E | 2023E | 2024E |
| Weight of debt [D/(D+E)] | 0,26 | 0,26 | 0,26 | 0,26 | 0,26 | 0,26 |
| Cost of debt (rd) | 3,65% | 3,65% | 3,65% | 3,65% | 3,65% | 3,65% |
| Weight of equity [E/(D+E)] | 0,74 | 0,74 | 0,74 | 0,74 | 0,74 | 0,74 |
| Required return on equity (re) | 5,79% | 5,79% | 5,79% | 5,79% | 5,79% | 5,79% |
| Marginal tax rate (t) | 6,97% | 6,97% | 6,97% | 6,97% | 6,97% | 6,97% |
| **WACC** | **5,18%** | **5,18%** | **5,18%** | **5,18%** | **5,18%** | **5,18%** |

| Discounted Free Cash Flow to Firm | | | | | | |
|---|---|---|---|---|---|---|
| | 2019E | 2020E | 2021E | 2022E | 2023E | 2024E |
| EBIT*(1-marginal tax rate) | 3 505 198 274 | 4 122 003 355 | 4 541 145 795 | 4 796 826 959 | 4 967 058 269 | 5 081 835 682 |
| Depreciation and amortization | 284 315 334 | 307 377 014 | 341 139 991 | 377 718 437 | 412 077 387 | 442 494 058 |
| Variation of NWC | 87 120 216 | 256 659 322 | 187 420 390 | 125 072 974 | 90 276 719 | 65 469 434 |
| CAPEX | 369 402 908 | 431 947 723 | 476 098 560 | 504 488 025 | 524 301 685 | 538 321 876 |
| **FCFF** | **3 332 990 483** | **3 740 773 324** | **4 218 766 836** | **4 544 984 397** | **4 764 557 252** | **4 920 538 431** |
| DCF Period (nº of years) | 1 | 2 | 3 | 4 | 5 | 6 |
| **Discounted Free Cash Flow to Firm** | **3 168 990 063** | **3 381 699 396** | **3 626 151 414** | **3 714 322 521** | **3 702 171 803** | **3 635 243 032** |

| Enterprise Value | |
|---|---|
| **Terminal Growth rate** | **2,80%** |
| **Perpetuity WACC** | **5,18%** |
| **Terminal value** | **212 966 951 176** |
| **PV of terminal value** | **157 337 786 552** |
| **NPV of FCFF** | **21 228 578 230** |
| **Enterprise Value** | **178 566 364 782** |

| Price Target | |
|---|---|
| **Enterprise Value** | **178 566 364 782** |
| **Net debt** | **-6 537 795 763** |
| **Equity value** | **185 104 160 546** |
| **Number of shares outstanding** | **609 555 294** |
| **Equity value per share** | **303,67** |
| **Small cap discount** | **0%** |
| **Price target ($)** | **303,67** |

## *Appendix 16: Beta Regression Output and Data*

| Regression Statistics | |
|---|---|
| Multiple R | 57,77% |
| R Squared | 0,33 |
| Adjusted R Squared | 33,34% |
| Standard Error | 0,024 |
| Observations | 2518 |

| ANOVA | Degrees of Freedom | Sum Square | Medium Square | F | Significance of F |
|---|---|---|---|---|---|
| Regression | 1 | 0,72 | 0,72 | 1260,00 | 4,2326E-224 |
| Residual | 2516 | 1,45 | 0,00 | | |
| Total | 2517 | 2,17 | | | |

| | Coefficients | Standard Error | T Statistic | P-value | Bellow 95% | Above 95% |
|---|---|---|---|---|---|---|
| Intercept | 0,00 | 0,00 | 1,22 | 0,22 | 0,00 | 0,00 |
| X 1 Variable | 1,33 | 0,04 | 35,50 | 0,00 | 1,26 | 1,40 |

Source: Author calculations

| Date | S&P500 prices | S&P500 variation | NVIDIA prices | NVIDIA variation |
|---|---|---|---|---|
| 27/05/2008 | 138,66 | | 23,36 | |
| 28/05/2008 | 139,3 | 0,460% | 23,58 | 0,937% |
| 29/05/2008 | 140 | 0,501% | 23,52 | -0,255% |
| 30/05/2008 | 140,35 | 0,250% | 24,7 | 4,895% |
| 02/06/2008 | 138,9 | -1,039% | 24,8 | 0,404% |
| 03/06/2008 | 138,09 | -0,585% | 23,96 | -3,446% |
| 04/06/2008 | 138,02 | -0,051% | 24,24 | 1,162% |
| 05/06/2008 | 140,78 | 1,980% | 24,85 | 2,485% |
| 06/06/2008 | 136,29 | -3,241% | 24,06 | -3,231% |
| 09/06/2008 | 136,62 | 0,242% | 23,69 | -1,550% |
| 10/06/2008 | 135,94 | -0,499% | 22,29 | -6,091% |
| 11/06/2008 | 133,94 | -1,482% | 21,25 | -4,778% |
| 12/06/2008 | 134,45 | 0,380% | 21,38 | 0,610% |
| 13/06/2008 | 136,15 | 1,256% | 21,31 | -0,328% |
| 16/06/2008 | 136,23 | 0,059% | 21,02 | -1,370% |
| 17/06/2008 | 135,57 | -0,486% | 20,51 | -2,456% |
| 18/06/2008 | 134,25 | -0,978% | 19,91 | -2,969% |
| 19/06/2008 | 134,42 | 0,127% | 19,86 | -0,251% |
| 20/06/2008 | 131,58 | -2,135% | 19,76 | -0,505% |
| 23/06/2008 | 131,45 | -0,099% | 19,35 | -2,097% |
| 24/06/2008 | 131,19 | -0,198% | 19,99 | 3,254% |
| 25/06/2008 | 131,81 | 0,471% | 20,1 | 0,549% |
| 25/05/2018 | 272,15 | -0,239% | 249,28 | 0,640% |

The data used in the regression is from 27/05/2008 to 27/05/2018. Due to the size of the table, just a sample of the data is shown in the appendix.

(NVIDIA Corporation, 2018)

Source: Bloomberg

## *Appendix 17: Selection of Peers*

To perform a selection of peers, we tried to selection companies with similar risk level, size, businesses, and life cycle phase comparable with NVIDIA. The parameters used were based on NVIDIA characteristics, on what we thought as plausible limits.

| To be considered as a peer the company must have | |
|---|---|
| **Adjusted beta** | **Between 1,2 and 1,8** |
| **Market cap** | **Between 50 Bi and 300 Bi** |
| **Correlation** | **Lower than -0,3 and higher than 0,3** |
| **ROE** | **Higher than 20%** |
| **Markets** | **Must operate at least 3 markets where NVIDIA operates** |
| **5-year average sales growth** | **Higher than 15%** |

| | Adjusted beta | Market cap | Correlation | ROE | Gaming | Professional Visualization | Data Center | Automotive | SoC | 5-year average growth sales | Peer? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NVIDIA | 1,33 | 159 580 000 000 | 1 | 46,05% | Yes | Yes | Yes | Yes | Yes | 21,38% | Yes |
| Advanced Micro Devices | 3,28 | 14 434 000 000 | 0,365 | 27,94% | Yes | Yes | Yes | Yes | Yes | -13,98% | Yes |
| Intel Corporation | 1,245 | 262 591 000 000 | 0,417 | 16,19% | No | No | Yes | Yes | Yes | 4,36% | Yes |
| Xilinx, Inc | 1,174 | 17 865 000 000 | 0,449 | 21,18% | No | Yes | Yes | Yes | No | 2,00% | Yes |
| Ambarella, Inc. | 1,137 | 1 637 654 006 | 0,271 | 4,02% | No | No | No | No | Yes | 15,71% | No |
| Broadcom Ltd. | 1,19 | 106 400 200 000 | 0,426 | 31,76% | No | No | Yes | No | Yes | 48,64% | Yes |
| Qualcomm Incorporated | 1,195 | 87 682 300 000 | 0,344 | -16,52% | No | No | No | Yes | Yes | -2,73% | No |
| Renesas Electronics Corporation | 1,237 | 17 146 900 000 | -0,004 | 3,48% | No | No | No | Yes | Yes | -0,18% | No |
| Texas Instruments Incorporated | 1,207 | 114 773 300 000 | 0,512 | 35,39% | No | No | Yes | Yes | Yes | 5,09% | Yes |
| Samsung | 1,65 | 330 849 000 000 | 0,038 | 12,87% | No | No | Yes | Yes | Yes | -7,39% | No |

## *Appendix 18: Market Multiple-based Valuation*

| | 2017 | | | | | | 2019 |
|---|---|---|---|---|---|---|---|
| | ***Intel Corporation*** | ***Advanced Micro Devices Inc*** | ***Xilinx, Inc*** | ***Texas Instruments Inc.*** | ***Broadcom Ltd.*** | ***Nvidia Corporation*** | |
| **EBITDA** | **20 671 000 000** | **348 000 000** | **762 020 000** | **6 987 000 000** | **7 120 000 000** | **2 308 000 000** | **4 336 499 920** |
| Operating Income | 17 936 000 000 | 204 000 000 | 699 394 000 | 6 083 000 000 | 2 383 000 000 | 2 121 000 000 | 4 052 184 586 |
| Depreciation and amortization | 2 735 000 000 | 144 000 000 | 62 626 000 | 904 000 000 | 4 737 000 000 | 187 000 000 | 284 315 334 |
| Sales | 62 800 000 000 | 5 329 000 000 | 2 349 330 000 | 14 961 000 000 | 17 636 000 000 | 6 910 000 000 | 9 714 000 000 |
| **EPS** | **2,06** | **0,04** | **2,51** | **3,74** | **4,36** | **2,80** | **5,68** |
| Shares outstanding (7) | 4 668 000 000 | 969 110 191 | 248 000 000 | 983 787 502 | 409 362 475 | 594 536 974 | 609 555 294 |
| Minority Interests | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Net income | 9 601 000 000 | 43 000 000 | 622 512 000 | 3 682 000 000 | 1 784 000 000 | 1 666 000 000 | 3 464 110 667 |
| **Book Value per share (9) = (10)/(7)** | **14,79** | **0,63** | **10,11** | **10,51** | **56,64** | **9,69** | **15,36** |
| Book value of equity (10) | 69 019 000 000 | 611 000 000 | 2 507 633 000 | 10 337 000 000 | 23 186 000 000 | 5 762 000 000 | 9 361 560 664 |
| Share price (11) | 36 | 11 | 64 | 80 | 114 | 137 | 290,74 |
| **Market Capitalization (12)=(11)*(7)** | **167 394 480 000** | **10 553 609 980** | **15 864 560 000** | **78 398 026 034** | **46 540 419 783** | **81 469 401 547** | **177 222 106 160** |
| Minority Interests | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total debt | 26 813 000 000 | 1 700 000 000 | 1 626 626 000 | 4 100 000 000 | 17 548 000 000 | 3 224 391 838 | 3 224 391 838 |
| Cash | 3 433 000 000 | 1 180 000 000 | 2 179 328 000 | 1 656 000 000 | 11 204 000 000 | 9 762 187 602 | 6 267 554 424 |
| **Enterprise Value** | **190 774 480 000** | **11 073 609 980** | **15 311 858 000** | **80 842 026 034** | **52 884 419 783** | **74 931 605 784** | **174 178 943 574** |
| **Multiples** | | | | | | | |
| Price-to-earnings | 17,44 | 245,43 | 25,48 | 21,29 | 26,09 | 48,90 | 51,16 |
| Price-to-book ratio | 2,43 | 17,27 | 6,33 | 7,58 | 2,01 | 14,14 | 18,93 |
| EV-to-EBITDA ratio | 9,23 | 31,82 | 20,09 | 11,57 | 7,43 | 32,47 | 40,17 |
| EV-to-Sales ratio | 3,04 | 2,08 | 6,52 | 5,40 | 3,00 | 10,84 | 17,93 |

| Multiples | | | | |
|---|---|---|---|---|
| | Price-to-earnings ratio | Price-to-book ratio | EV-to-EBITDA ratio | EV-to-Sales ratio |
| NVIDIA | 51,16 | 18,93 | 40,17 | 17,93 |
| Intel Corporation | 17,44 | 2,43 | 9,23 | 3,04 |
| Advanced Micro Devices Inc | 245,43 | 17,27 | 31,82 | 2,08 |
| Xilinx, Inc | 25,48 | 6,33 | 20,09 | 6,52 |
| Texas Instruments Inc. | 21,29 | 7,58 | 11,57 | 5,40 |
| Broadcom Ltd. | 26,09 | 2,01 | 7,43 | 3,00 |
| **Arithmetic mean** | **67,15** | **7,12** | **16,03** | **4,01** |

| Multiples | Price target ($) |
|---|---|
| Price-to-earnings ratio | 381,59 |
| Price-to-book ratio | 109,40 |
| EV-to-EBITDA ratio | 119,02 |
| EV-to-Sales ratio | 68,85 |

## *Appendix 19: Sensitivity Analysis*

| BPI's Investment Rating and Risk Classification | | | |
|---|---|---|---|
| | Low Risk | Medium Risk | High Risk |
| Buy | >15% | >20% | >30% |
| Neutral | >5% and 15%< | >10% and 20%< | >15% and 30%< |
| Reduce | >-10% and 5%< | >-10% and 10%< | >-10% and 15%< |
| Sell | < -10 % | < -10% | |

We used the BPI's Investment Rating and Risk Classification in our sensitivity analysis.

| Volatility | |
|---|---|
| S&P500 Daily Std. Dev | 1,28% |
| NVIDIA Daily Std. Dev | 2,94% |
| S&P500 Annual Std. Dev | 20,17% |
| NVIDIA Annual Std. Dev | 46,43% |
| **Performance** | |
| S&P500 Last 5 years performance | 49,26% |
| NVIDIA Last 5 years performance | 284,24% |
| **Liquidity** | |
| 50 Day Avg. Daily Volume of NASDAQ | 768 481 |
| 50 Day Avg. Daily Volume of NVIDIA | 8 515 941 |
| **Dimension** | |
| Average S&P500 Market Cap | 53,03 Bi |
| NVIDIA Market Cap | 152,98 Bi |

To classify NVIDIA risk we used four criteria's, stock volatility, stock performance, stock liquidity and dimension. Regarding volatility, comparing with S&P500, NVIDIA is more volatile, based in both daily and annual standard deviation which negatively influences the allocation of a low risk classification. NVIDIA had a higher performance in the last 5 years, which influences positively an attribution of a lower risk rating. In terms of liquidity, NVIDIA transacted more than 10 times what the average transacted in NASDAQ which positively benefits a low risk classification. Finally, NVIDIA with a higher market capitalization than the average of S&P500, it is also indicator of a low risk investment. Considering all four criteria's indicated and the analysis in the report, we considered NVIDIA as a **Medium Risk** investment.

| Investment Rating for medium risk company | | |
|---|---|---|
| Initial Price ($) | 244,47 | |
| Buy | 293,36 | |
| Neutral | 268,92 | 293,36 |
| Reduce | 220,02 | 268,92 |
| Sell | 220,02 | |

With the last year's growth revenue, betting the market, NVIDIA growth started to become more skeptical, even more after the increase of the correlation between variation of cryptocurrency and NVIDIA stock value. This possible increase of uncertainty can change NVIDIA beta and consequently NVDIA cost of equity and its cost of debt. With constant beta, to reach a sell recommendation the cost of debt needs to be, for example, at 8,15% in the next years. For a sell recommendation through a beta alteration, its needs to reach, for example, 1,93.

| | | Beta | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 303,67 | 1,18 | 1,23 | 1,28 | 1,33 | 1,63 | 1,93 | 2,23 |
| Cost of debt (rd) | 9,65% | 204,91 | 200,59 | 196,46 | 192,49 | 171,83 | 155,33 | 141,85 |
| | 8,15% | 226,88 | 221,55 | 216,48 | 211,64 | 186,75 | 167,28 | 151,64 |
| | 6,65% | 254,35 | 247,62 | 241,25 | 235,21 | 204,66 | 181,35 | 162,98 |
| | 5,15% | 289,71 | 280,95 | 272,71 | 264,96 | 226,56 | 198,14 | 176,27 |
| | 3,65% | 336,91 | 325,03 | 313,98 | 303,67 | 253,95 | 218,54 | 192,04 |
| | 3,15% | 356,37 | 343,07 | 330,75 | 319,30 | 264,67 | 226,35 | 197,98 |
| | 2,65% | 378,27 | 363,29 | 349,46 | 336,68 | 276,37 | 234,76 | 204,32 |

Not only investors are skeptical over NVDIA future growth rates, but also over the actual policy measures of the USA government. These measures can change the government bonds rates that are used as benchmark for the free risk rate. One in particular can have directly impact NVIDIA price target that is the corporate tax rate, that consequently change the marginal tax rate. This tax rate can change at least to 30,47% in the next years, without changing the recommendation to sell. Regarding the free-risk rate, a variation of 1,5 percentage points keeps the recommendation out of reduce.

| | | Marginal tax rate | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 303,67 | 2,97% | 4,97% | 6,97% | 12,47% | 17,97% | 23,47% | 30,47% |
| Free-risk rate (rf) | 4,43% | 366,62 | 362,28 | 357,85 | 345,24 | 331,95 | 317,90 | 298,85 |
| | 3,93% | 346,33 | 342,06 | 337,71 | 325,36 | 312,37 | 298,69 | 280,22 |
| | 3,43% | 328,21 | 324,02 | 319,77 | 307,68 | 295,02 | 281,73 | 263,83 |
| | 2,93% | 311,93 | 307,83 | 303,67 | 291,88 | 279,54 | 266,63 | 249,30 |
| | 2,73% | 305,87 | 301,81 | 297,69 | 286,01 | 273,81 | 261,05 | 243,94 |
| | 2,53% | 300,05 | 296,03 | 291,94 | 280,38 | 268,31 | 255,70 | 238,82 |
| | 1,53% | 274,05 | 270,21 | 266,33 | 255,34 | 243,93 | 232,04 | 216,21 |

Other risk that NVIDIA faced over the last years, is the risk of segments wind downs, as occurred with Icera, and the possibility of new IP disputes that can affect NVIDIA earnings. To change the recommendation to sell (with a change to initial price of -28,6%), the R&OC have to reach, for example, 3% of total revenue per year, combined with a 14,39% SG&A to revenue ratio every year. With a very pessimist approach, if R&OC and SG&A to revenue reach 6% and 14,39%, respectively, there will be a price target variation of -38%.

| | | SG&A to revenue | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 303,67 | 2,39% | 4,39% | 6,39% | 8,39% | 10,39% | 12,39% | 14,39% |
| R&OC to revenue | 6,00% | 303,67 | 284,39 | 265,11 | 245,82 | 226,54 | 207,26 | 187,97 |
| | 5,00% | 313,31 | 294,03 | 274,75 | 255,46 | 236,18 | 216,90 | 197,62 |
| | 4,00% | 322,95 | 303,67 | 284,39 | 265,11 | 245,82 | 226,54 | 207,26 |
| | 3,00% | 332,59 | 313,31 | 294,03 | 274,75 | 255,46 | 236,18 | 216,90 |
| | 2,00% | 342,24 | 322,95 | 303,67 | 284,39 | 265,11 | 245,82 | 226,54 |
| | 1,00% | 351,88 | 332,59 | 313,31 | 294,03 | 274,75 | 255,46 | 236,18 |
| | 0,00% | 361,52 | 342,24 | 322,95 | 303,67 | 284,39 | 265,11 | 245,82 |

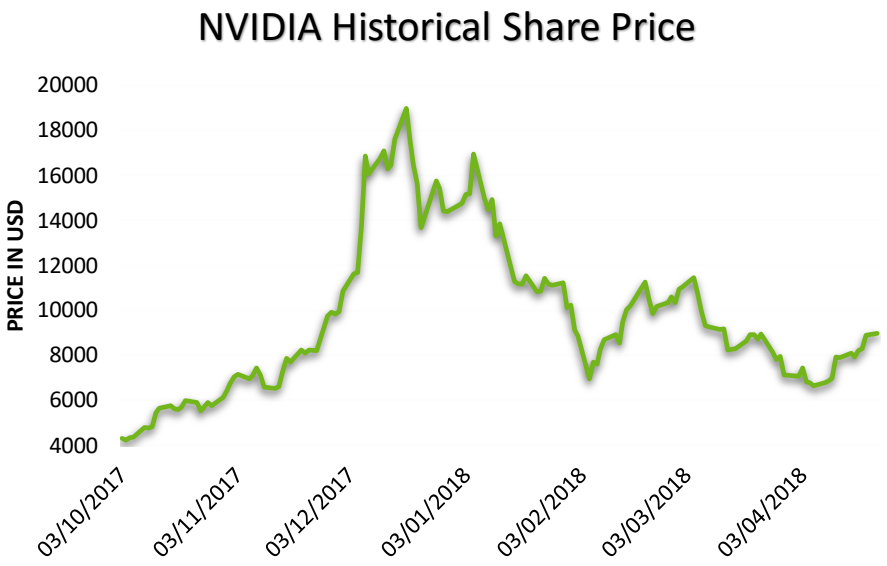
## *Appendix 20: Monte Carlo Simulation*

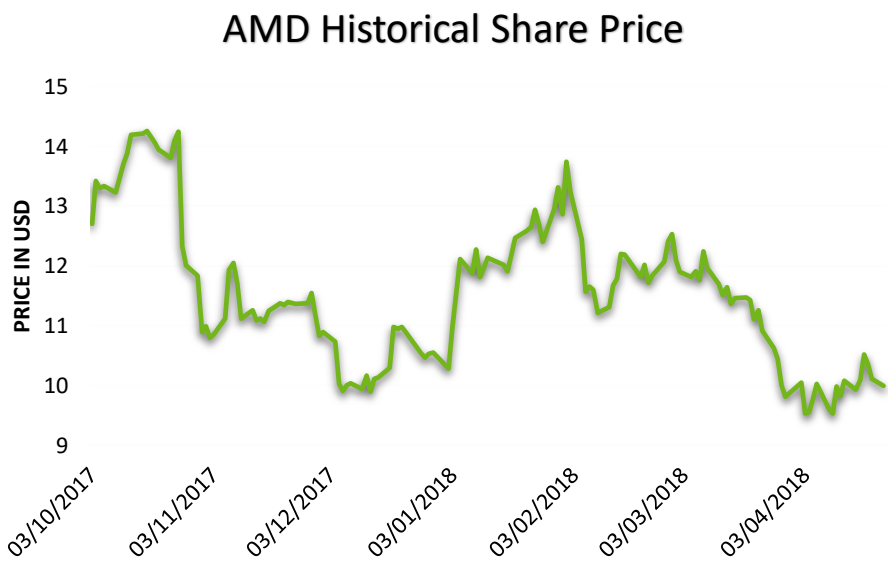
| Statistics: | |
|---|---|
| **Trials** | **100 000** |
| **Base Case** | **303,67** |
| **Mean** | **239,00** |
| **Median** | **231,74** |
| **Mode** | **---** |
| **Standard Deviation** | **66,05** |
| **Variance** | **4 363,22** |
| **Skewness** | **0,81** |
| **Kurtosis** | **4,66** |
| **Coeff. of Variation** | **0,28** |
| **Minimum** | **18,11** |
| **Maximum** | **829,93** |
| **Range Width** | **811,82** |
| **Mean Std. Error** | **0,21** |

| Crystal Ball Inputs | | | | |
|---|---|---|---|---|
| ***Variable*** | ***Mean*** | ***Std. Dev*** | ***Distribution*** | ***Explanation*** |
| Equity Risk Premium | 5,08% | 0,51% | Normal | Checks the sensitivity changes of the equity risk premium on the target price. |
| Beta | 1,33 | 0,133 | Normal | Checks the sensitivity changes of the beta on the target price. |
| Free-risk rate (rf) | 2,93% | 0,29% | Normal | Checks the sensitivity changes of the free risk rate on the target price. |
| Cost of debt (rd) | 3,65% | 0,36% | Normal | Checks the sensitivity changes of the cost of debt on the target price. |
| Marginal tax rate (t) | 6,97% | 0,70% | Normal | Checks the sensitivity changes of the marginal tax rate on the target price. |
| WACC | 5,18% | 0,52% | Normal | Checks the sensitivity changes of the WACC on the target price. |
| Gross Margin (%) | 60,89% | 6,09% | Normal | Checks the sensitivity changes of the gross margin on the target price. |
| R&D to revenue ratio | 18,50% | 1,85% | Normal | Checks the sensitivity changes of the R&D to revenue ratio on the target price. |
| Days Inventory Outstanding (DIO) | 81,66 | 8,17 | Normal | Checks the sensitivity changes of the DIO on the target price. |
| Days Sales Outstanding (DSO) | 36,89 | 3,69 | Normal | Checks the sensitivity changes of the DSO on the target price. |
| Days Payable Outstanding (DPO) | 56,30 | 5,63 | Normal | Checks the sensitivity changes of the DPO on the target price. |
| Terminal Growth rate | 2,80% | 0,28% | Normal | Checks the sensitivity changes of the terminal growth rate on the target price. |
| Cap Ex to sales ratio | 3,10% | 0,31% | Normal | Checks the sensitivity changes of the capital expenditures to sales ratio on the target price. |

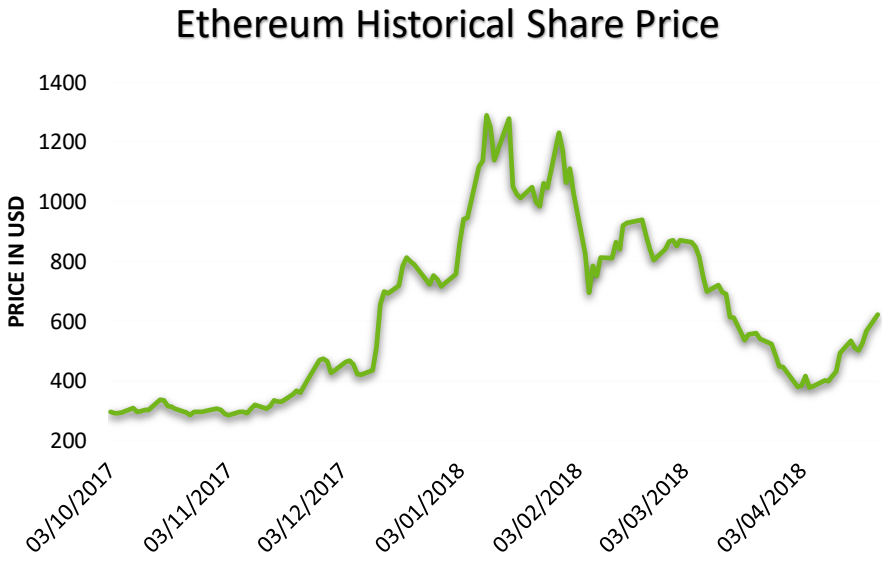
Source: Crystal Ball

***Appendix 21: Correlation between NVIDIA stock and Cryptocurrency prices***







***Appendix 22: GPU vs FPGA performance***

| Feature | Analysis | Winner |
|---|---|---|
| Floating-Point Processing | The total floating-point operations per second of the best GPUs are higher than the FPGAs' with the maximum DSP capabilities. | GPU |
| Timing Latency | Algorithms implemented into FPGA provide deterministic timing, with latencies one order of magnitude less than GPUs. | FPGA |
| Interfaces | Measuring GFLOPS per watt, FPGAs are 3-4 times better. Although still far away, latest GPU products are dramatically improving the power burning. | FPGA |
| Processing / Watt | GPUs interface via PCIe, while FPGA flexibility allows connection to any other device via - almost- any physical standard or custom interface. | FPGA |
| Backward Compatibility | Software developed for older GPUs will work in the new devices. FPGA HDL can be moved to newer platforms, but with some reworking. | GPU |
| Flexibility | FPGA lacks flexibility to modify the hardware implementation of the synthesized code, being a no-problem issue for GPUs developers. | GPU |
| Size | FPGA's lower power consumption requires less thermal dissipation countermeasures, implementing the solution in smaller dimensions. | FPGA |
| Development | Many algorithms are designed directly for GPUs, and FPGA developers are difficult and expensive to hire. | GPU |
| Processing / € | Mid-class devices can be compared within the same order of magnitude, but GPU wins when considering money per GFLOP. | GPU |

# References


NVIDA Corporation (2018). NVIDIA Corporation Annual Review 2018. Available on: https://investor.nvidia.com/financial-info/financial-reports/default.asp

Jon Peddie Research (2017). GPU Developments in 2017. Available on: https://www.jonpeddie.com/press-releases/gpu-developments-in-2017

Design&Refuse (2017). NVIDIA, and AMD Increase GPU Attach Rates While Total GPU Shipments Remain Flat Quarter to Quarter. Available on: https://www.design-reuse.com/news/41424/q4-2016-total-gpu-shipments.html

Forbes (2018). How Discrete GPU Market Growth Can Boost Nvidia's Results. Available on: https://www.forbes.com/sites/greatspeculations/2018/03/12/how-discrete-gpu-market-growth-can-boost-nvidias-results/#2fcde3391dd8

Deloitte (2018). China's economy cools as US trade tension heats up. Available on: https://www2.deloitte.com/insights/us/en/economy/asia-pacific/china-economic-outlook.html#endnote-2

South China Morning Post (2017). China's new economy grows twice as fast as GDP and helps offset job losses, says top think tank. Available on: https://www.scmp.com/business/companies/article/2124979/chinas-new-economy-grows-twice-fast-gdp-and-helps-offset-job

Deloitte Insights (2017). Taiwan: Export growth bodes well for GDP expansion. Available on: https://www2.deloitte.com/insights/us/en/economy/asia-pacific-economic-outlook/2017/q4-taiwan.html

Chinese Academy of Social Sciences (2015). Two-child policy' to tackle aging population. Available on: http://casseng.cssn.cn/news_events/news_events_special_report/201712/t20171221_3788210.html

Bloomberg (2018). The Biggest Threats to China's Economy in 2018. Available on: https://www.bloomberg.com/news/articles/2018-01-01/china-warms-up-for-2018-critical-battles-with-cooling-economy

The Balance (2018). Trade Wars and How They Affect You. Available on: https://www.thebalance.com/trade-wars-definition-how-it-affects-you-4159973

New York Times (2018). Will 2018 Be the Year of Protectionism? Trump Alone Will Decide. Available on: https://www.nytimes.com/2018/01/03/us/politics/2018-trump-protectionism-tariffs.html

Euromonitor International (2017). US Economic Outlook, Q4 2017. Available on: https://blog.euromonitor.com/2017/12/us-economic-outlook-q4-2017.html

The Balance (2018). Donald Trump's Economic Plan. Available on: https://www.thebalance.com/donald-trump-economic-plan-3994106

GFK (2017). PC Gaming still on the rise. Available on: https://www.gfk.com/fileadmin/user_upload/dyna_content/Global/documents/Press_Releases/2017/20170830_PM_IFA_IT_efin.pdf

The Register (2016). Nvidia's patent war on Samsung is a wreck – what you need to know. Available on: https://www.theregister.co.uk/2016/01/07/nvidia_and_samsung_patent_battle

Allied Market Research (2016). Advance Driver Assistance Systems Market by Component Type: Global Opportunity Analysis and Industry Forecast, 2017-2025. Available on: https://www.alliedmarketresearch.com/press-release/advanced-driver-assistance-sysytem-market-is-expected-to-reach-60-14-billion-global-by-2020-allied-market-research.html

Mckinsey (2016): Automotive revolution – Perspective towards 2030. Available on: https://www.mckinsey.com/~/media/mckinsey/industries/high%20tech/our%20insights/disruptive%20trends%20that%20will%20transform%20the%20auto%20industry/auto%202030%20report%20jan%202016.ashx

Future Market Insights (2018): Visual Computing Market: Global Industry Analysis and Opportunity Assessment 2017-2027. Available on: https://www.futuremarketinsights.com/reports/visual-computing-market

Market Realist (2018): Should Advanced Micro Devices, Nvidia Worry about Cryptocurrency? Available on: https://marketrealist.com/2018/01/advanced-micro-devices-nvidia-worry-cryptocurrency

Market Realist (2018): Accelerated Computing Boosts NVIDIA's Revenue Growth Rate. Avalilable on: https://marketrealist.com/2018/08/accelerated-computing-boosts-nvidias-revenue-growth-rate

Ross, Westerfield, Jasse (2016). *Corporate Finance*. Sixth Edition. McGraw-Hill Primis

Berk, Jonathan, DeMarzo, Peter (2014). *Corporate Finance*. Third Edition. Person

Pinto, J.; Henry, E.; Robinson, T.; Stowe, J.; Miller, P. (2016), *Equity Asset Valuation*. Third edition, CFA Investment Series. John Wiley & Sons, Inc.

Moschella, John, (2017*), Financial Modeling For Equity Research: A Step-by-Step Guide to Earnings Modeling*. First edition, Guntenberg Research Publishing Company.

Kalish, D. I. (2017, September 28). *Deloitte*. Taiwan: Export growth bodes well for GDP expansion. Available on: https://www2.deloitte.com/insights/us/en/economy/asia-pacific-economic-outlook/2017/q4-taiwan.html

Bitmain Technologies Holding Company. (2018). *Application Proof of Bitmain.* Available on: http://www.hkexnews.hk/APP/SEHK/2018/2018092406/Documents/SEHK201809260017.pdf

NewZoo. (2018). *Global Esport Market Report.*

Research, J. P. (2017, February 16). *Design&Refuse*. Nvidia, and AMD Increase GPU Attach Rates While Total GPU Shipments Remain Flat Quarter to Quarter. Available on: https://www.design-reuse.com/news/41424/q4-2016-total-gpu-shipments.html

Research, J. P. (2017). *GPU Developments in 2017.*

Sciences, T. C. (2016). *China Population and Labor Report No.17.*