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Equity Valuation of Advanced Micro Devices (AMD)

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Master in Finance

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Iscte-Iul

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BUSINESS
SCHOOL

Department of Finance

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Resumo

O objectivo principal desta tese é desenvolver uma avaliação da "Advanced Micro Devices" (AMD) baseada numa análise fundamental e desenvolver modelos financeiros usando métodos como o *DCF* e avaliação relativa.

Inicialmente é apresentada uma análise aprofundada da empresa, permitindo assim ter uma melhor visão da posição global da empresa. Esta análise é focada nos segmentos, estratégia e performance financeira da empresa. Seguidamente, é conduzida uma análise da indústria dos semiconductores obtendo-se assim uma melhor visão do panorama macroeconómico e industrial em que a AMD está inserida. Por último, são apresentados modelos financeiros usando os métodos apresentados na revisão de literatura, sendo estes usados para obter conclusões na avaliação da AMD. Outro tópico relacionado com esta avaliação é a acquisição da Xilinx por parte da AMD, sendo este um ponto de destaque para estudar o possível crescimento da AMD. Outro destaque relacionado é a acquisição da *Arm* pela Nvidia, sendo uma análise importante para perceber o futuro da indústria dos semicondutores.

Os resultados finais da avaliação mostraram um preço justo por acção para a AMD de $114.54 e $105 usando as abordagens de perpetuidade e múltiplo EBITDA de saída, respectivamente. Para o cenário de acquisição da Xilinx por parte da AMD, o preço justo foi $123.29 com a abordagem de perpetuidade e $119.56 com a abordagem de múltiplo EBITDA de saída. Estes resultados foram comparados com o preço atual das acções da AMD de $105.80 (24 Setembro 2021) e usados como base para fazer uma recomendação final de "Compra" à AMD.

Palavras-chave: Avaliação de empresas, Fluxo de Caixa descontado, avaliação de múltiplos, avaliação relativa, fusões e acquisições, indústria semiconductores.

JEL Classification: G30, G32, G34

Abstract

The main objective of this thesis is to develop a valuation of Advanced Micro Devices (AMD) based on fundamental analysis and development of financial models using methods such as the discounted cash flows and relative valuation.

Firstly, an in-depth analysis of the company is presented to get a better view of its overall position, focusing on its segments, strategy, and financial performance. Secondly, an analysis of the industry of semiconductors is made to get a scope of the macroeconomic environment in which AMD is inserted. Lastly, financial models are presented using methods based on the review of literature and used to draw conclusions on AMD's final valuation. Another topic tied to this valuation is Mergers & Acquisitions (M&A), with the acquisition of Xilinx by AMD being a very high focus point to study the recent high growth of AMD and the acquisition of Arm by Nvidia to study the future of the semiconductors industry.

The final results of the valuation showed a fair share price for AMD of \$114.54 and \$105 using a perpetuity and exit EBITDA multiple approaches, respectively. For the scenario of conclusion of Xilinx acquisition by AMD, the fair share price presented was \$123.29 for the perpetuity approach and \$119.56 for the exit EBITDA multiple approach. These results were compared to the current market price of \$105.8 (as of September 24th, 2021) and used as a foundation to issue a final recommendation of "Buy" on AMD's stock.

Keywords: Company valuation, Discounted Cash flow, multiple valuation, relative valuation, mergers & acquisitions, semiconductors industry.

JEL Classification: G30, G32, G34

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Glossary

AMD – Advanced Micro Devices

APU – Accelerated Processing Unit

C&G – Computing & Graphics

CAPM – Capital Assets Pricing Model

CPU – Central Processing Unit

DCF – Discounted Cash Flow

EBITDA – Earnings Before Interest, Taxes, Depreciation and Amortization

EE&SC – Enterprise, Embedded and Semi-custom

EV – Enterprise Value

FCFF – Free Cash Flow to the Firm

FCFE – Free Cash Flow to Equity

GPUs – Graphic Processing Units

HPC – High Performance Computing

Non-GAAP – non Generally Accepted Accounting Principles

PP&E – Property, Plant and Equipment

R&D – Research and Development

SoC – System on Chip

TAM – Total Addressable Market

The Company – Advanced Micro Devices

TSMC - Taiwan Semiconductor Manufacturing Company

TV – Terminal Value

US – United States

WACC – Weighted Average Cost of Capital

YoY – Year over Year

1. Introduction

AMD develops high-performance computing and graphics products in the semiconductor industry. AMD reports operations under two segments – Computing & Graphics, and Enterprise, Embedded & Semi-custom. The Computing & Graphics segment includes processors, chipsets, and graphics processing units (GPUs), whereas the Enterprise, Embedded & Semi-custom includes server and embedded processors, dense servers, semi-custom System-on-Chip (SoC) products, engineering services and royalties. The company has established its presence well in both business to consumer and business to business sectors and has seen a very high growth in the last years, especially in the year 2020. In the same year, AMD has also announced the acquisition of Xilinx, another microprocessor's developer.

This thesis gives insights about AMD's overall position in the present, as well as its strategy and growth for the future with a focus on its pending acquisition. The first chapter Literature Review includes a description of the main valuation models cited by the most important authors in the area. The chapters number 3, 4, 6, 7, 8 and 9 provide an in-depth analysis of AMD and its competitors. In chapter number 5 it is presented an analysis on the current state of AMD's industry. In chapter number 10 the appropriate valuation models are performed to show what the fair share price of AMD is, as well as a description of the assumptions made. To conclude, in chapter 11 the results are evaluated and a recommendation is given on AMD's stock.

2. Literature Review

2.1. Discounted Cash Flow model

The discounted cash flow model is the most frequently used model on valuation and consists on discounting the company's future cash flows at a discounting rate based on the cash flow's risk, giving us the present value of the company's future cash flows. The model is a basis of other variations often used in valuation and presented next: the Free Cash Flow to Equity model (FCFE), the Free cash flow to the Firm (FCFF), the Dividend Discount Model (DDM) and the Adjusted Present Value (APV) model (Damodaran, 2012).

2.2. Free Cash Flow to Equity (FCFE)

The free cash flow to equity discount model values equity using the free cash flows to equity and discounting them at the cost of equity.

Damodaran (2012) presents three versions of the valuation model depending on the growth stage and prospects of the company – (1) companies growing with a steady growth rate, (2) fast initial growth period followed by a steady one, and (3) fast initial growth period followed by a declining growth period followed by a steady growth one. Each version has its use depending on the type of firm, with the second (2) one being the most frequently used:

$$Equity\ Value = \sum_{t=1}^{t=n} \frac{FCFE_t}{(1+r_e)^t} + \frac{TV_n}{(1+r_e)^n} \tag{1}$$

where,

r_e = cost of equity

and the Terminal Value (TV_n) is calculated using the Gordon Growth Model:

$$TV_n = \frac{FCFE_{n+1}}{(r_e - g_n)} \tag{2}$$

where,

$FCFE_{n+1}$ = Free cash flow to equity for the next year

g_n = growth rate of FCFE in perpetuity

The free cash flow to equity is defined as the cash flows available for shareholders, which result from the deduction of all payments for debtholders and the company's reinvestment needs. The calculation starts with net income and adds cash inflows and subtracts cash outflows. Since depreciation is a non-cash expense that was subtracted to get net income, it is added back now since we are calculating cash flows. Decreases in working capital and issuance of new debt are also added since they represent cash inflows for the company. Capital expenditures, increases in working capital and debt repayment are cash outflows for the company and so are subtracted on the formula. The equation can be written as follows (Damodaran, 2012):

$$\begin{aligned} FCFE = Net\ income - (Capital\ expenditures - Depreciation) \\ - (Change\ in\ noncash\ working\ capital) + (New\ debt\ issued \\ - Debt\ repayments) \end{aligned} \tag{3}$$

The cost of equity is defined as the required rate of return for shareholders. Therefore, it is calculated by measuring market risk. There are numerous models to calculate it such as the capital asset pricing model (CAPM), the arbitrage pricing model (APM), the Fama and French three factor model, alternative distribution models and the regression or proxy models (Damodaran, 2012).

The CAPM is the most known and widely used model. However, Fama and French (2004) considered the model as an empirical failure, raising significant issues that could nullify most applications of the model. In spite of these problems, a survey from Bruner, Eades, Harris, and Higgins (1998) to 27 highly regarded corporations revealed that 81% used CAPM, 4% used a modified CAPM, and 15% were not applicable to answer. Damodaran (2012) considers that the model's popularity is not only due to its simplicity and intuitive appeal, but also due to lack of improvement in more complex models, specifically in evidence on development of the accuracy of future forecasts. The author also argues that the most effective way to use the model to estimate the cost of equity is not being too dependent on historical data.

The calculation of the cost of equity using CAPM is:

$$r_e = R_f + \beta * (ER_m - R_f) \tag{4}$$

Where,

R_f = Risk-free rate

β = Beta

ER_m = Expected return on the market

The risk-free rate should be a default free zero-coupon rate that is consistent with the period of the cash flow analysis. Therefore, the rate usually used is a long-term government bond.

The market risk premium, composed by the Expected return on the market minus the risk-free rate, is calculated using historical data on equity returns. For analysis on riskier countries, it is also added a country risk premium that captures the company's exposure to the higher country's risk.

The beta can be estimated using various approaches like through market historical data and through fundamental data of the company. The most conventional method is through historical data, and consists on estimating a regression of the company's stock returns against market returns. The slope of that regression is the beta of the stock. However, the historical approach yields imprecise and skewed estimates with high standard errors, making it a poor choice on beta estimation. The fundamental approach is considered a superior method and consists on estimating and computing average betas for comparable firms (Damodaran, 2012).

2.3. Free cash flow to the Firm (FCFF)

The free cash flow to the firm discount model values the entire firm using the weighted average cost of capital (WACC) as a discount rate to the sum of the expected cash flows to all claim holders in the company. The free cash flows to the firm are calculated before debt payments, as it follows:

$$FCFF = EBIT(1 - Tax\,rate) - Capital\ expenditures + Depreciation - (Change\ in\ working\ capital) \tag{5}$$

The most general use of the free cash flow to the firm model is calculated as:

$$Firm\,Value = \sum_{t=1}^{t=n} \frac{FCFF_t}{(1+WACC)^t} + \frac{TV_n}{(1+WACC)^n} \tag{6}$$

where,

$$TV_n = \frac{FCFF_{n+1}}{(WACC - g_n)} \tag{7}$$

The WACC is the weighted average cost of capital for the firm, and it is used since we are now valuing cash flows to the firm and not only to equity. Hence, we need to discount these cash flows according to the cost of capital, which depends on the amount of debt and equity that the company chose to finance itself:

$$WACC = \frac{E}{D+E} \times r_e + \frac{D}{D+E} \times r_d \times (1 - Tax\ rate) \quad (8)$$

Where,

r_d = cost of debt

The weighted average cost of capital formula allows for adjustments to the financial leverage of the firm which, along with the calculation of free cash flows prior to debt payments, makes the model a popular approach to value a firm that changes its leverage relatively often (Damodaran, 2012).

It is also noticeable in the weighted average cost of capital formula that it captures the value of the tax shield, defined by (Koller *et al.*, 2015):

$$After - tax\ cost\ of\ Debt = Cost\ of\ Debt \times (1 - Marginal\ Tax\ rate) \quad (9)$$

2.4. Adjusted Present Value (APV)

The adjusted present value was first introduced by Stewart Myers (1974) as an alternative method to evaluate capital investment decisions. The model consists on calculating the unlevered firm value and adding to them the present value of the interest tax shields:

$$APV = Unlevered\ Firm\ Value + PV\ of\ Tax\ shields \quad (10)$$

The unlevered firm value is calculated by discounting the free cash flows to the firm at the unlevered cost of equity.

In his work, Myers also highlights that whereas in the Modigliani-Miller work the leverage ratio is assumed to remain unchanged, the APV is flexible and allows changes in the ratio. Damodaran (2012) also acknowledges this flexibility, and Luehrman (1997) goes even further and claims that WACC became obsolete, since APV works without needing the restrictive assumptions that WACC needs.

Myers (1974) also mentions some possible limitations of APV like having a higher complexity than the traditional models. Damodaran (2012) also considers APV to be more complex since it is difficult to calculate probabilities of default and costs of bankruptcy. For the author it is very important to account for expected bankruptcy costs when calculating the tax benefits, which is something that is often overlooked by practitioners, and causes flaws in the practice application of the model.

2.5. Dividend Discount Model (DDM)

The dividend discount model values a company through the dividends that the company pays to its shareholders. The model is based on the concept of present value of a growing perpetuity.

$$\text{Value } per\ share\ of\ stock = \frac{EDPS}{(r_e - g)} \tag{11}$$

where,

EDPS = Expected dividend per share

g = dividend growth rate in perpetuity

This version of the model assumes the company is in a steady growth phase and dividends are expected to grow at a rate that can be supported for perpetuity. To sustain that growth rate, it is also assumed that performance metrics such as earnings and costs grow at the same rate, keeping the payout ratios supportable.

There are more complex variations of the model that can be used on companies that go through different stages of growth. To choose which model's variation best suits the company, it is necessary to analyse which assumptions can be made for the future (Damodaran, 2012).

2.6. Relative Valuation (multiples)

In relative valuation, a company's value is determined based on other comparable firms' value currently priced in the market. For this comparison to be possible, the company's prices have to be converted into multiples, therefore standardizing their values. The company's value can be expressed mainly through four different types of multiples – earnings, book value, revenue, or sector-specific multiples. (Damodaran, 2012)

Both Damodaran (2012) and Koller (2015) agree that valuation through multiples can be often misused and produce incorrect conclusions. Damodaran (2012) provides four steps to correctly apply multiples – (1) equal definition and measurement of the multiple across different firms, (2) acknowledge how the multiples' value is distributed across different companies, (3) determine the fundamentals that change each variable and how it affects the multiples' value, and (4) define and find comparable firms. Since no companies are truly identical, it is also necessary to adapt for the differences between the companies when making the comparison. Additionally, it is also useful to account for the effects of outliers and the biases it creates when estimating a multiples value.

Koller (2005) states four principles that help companies apply multiples and draw useful conclusions about them – (1) assemble a list of comparable firms and search for peers with similar ROICs and growth prospects, (2) use multiples based on forecasted data rather than trailing multiples, that are based on historical data, (3) use enterprise value instead of price multiples, since enterprise value includes both debt and equity, it is less susceptible to be manipulated by changes on the company's leverage, and (4) exclude excess cash and include operating leases from enterprise value and the interest expense to EBITDA to get the right adjustments for the enterprise-value-to-EBITDA multiple.

When executed correctly, a relative valuation provides information for the company of its position and strategy relative to its competitors. It can also complement a discounted cash flows valuation and verify its results. However, in a discounted cash flow valuation we assume the markets can be mistakenly priced, whereas in a relative valuation we assume that while a company's price might be incorrect, its comparable firms is not. Damodaran (2015: 648) alerts for this inaccuracy "a stock may be overvalued on a discounted cash flow basis but undervalued on a relative basis, if the firms used in the relative valuation are all overpriced by the market. The reverse would occur if an entire sector or market were underpriced." (Damodaran, 2015; Koller *et al*., 2015).

2.7. Economic Value Added (EVA)

The economic value added is a measurement of the value a company created from the funds that were invested in it. It can be calculated through three inputs – the capital invested, the return on capital invested, and the cost of that capital (Damodaran, 2012):

$$EVA = (ROIC - WACC) \times IC \tag{12}$$

or,

$$EVA = NOPAT - (IC \times WACC) \tag{13}$$

where,

IC – Invested capital

ROIC – Return on invested capital

NOPAT – Net operating profit after taxes

EVA's simplicity is an advantage for many managers since it shifts the perspective to only invest if the value created covers the cost of capital, and extract the most value of assets and discard the ones that are underutilized (Brealey *et al.*, 2020). Another advantage is the connection it has to the net present value (NPV) concept, and how a firm can increase its value by investing in positive NPV projects. However, this can also become a disadvantage since managers can reduce the company's value but make the company look better by investing on riskier projects to increase the present EVA and compromise the future growth of the company (Damodaran, 2012).

3. Company Overview

3.1. History

Advanced Micro Devices (AMD) was founded in 1969, California. It is currently listed on NASDAQ's Global Select Market (NASDAQ-GS large cap) under the ticker "AMD". The Company has been producing x86 microprocessors since 1981, when it entered an agreement with Intel to produce the processors for the first personal computer (PC) built.

AMD outsources its silicon wafers to third-party manufacturers like Taiwan Semiconductor Manufacturing Company Limited (TSMC) for processor nodes under 7 nanometres, and GlobalFoundries for the remaining products larger than that. In fact, AMD has a Wafer Supply Agreement (WSA) with GlobalFoundries to purchase all its microprocessors and APU product requirements. Besides, the Company also relies on ATMP to assemble, test, mark and pack its products.

3.2. Business Segments

AMD currently divides their operations in two business segments: Computing and Graphics Products, and Enterprise, Embedded and Semi-custom. The Company currently estimates its total addressable market to be roughly $79 Billion, with its first segment Computing and Graphics Products (C&G) responsible for nearly $44 Billion, and its second segment Enterprise, Embedded and Semi-custom (EE&SC) responsible for about $35 Billion.

3.2.1. Computing and Graphics Products

Although this segment groups computing and graphics products together, it is more useful to analyse them individually.

Regarding computing products, AMD has two main families of processors: Ryzen and Epyc. Both Ryzen and Epic have been AMD's gems that laid the ground to the success they have today, with Ryzen being the choice for desktop and laptop consumers, and workstations. Epyc is the family of processors designed for enterprise use, on servers and data centers, which belongs on AMD's Enterprise, Embedded and Semi-custom segment. Between Ryzen and Epic, AMD saw the opportunity to create a line of processors with more cores and more processing power than their best Ryzen models, launching a new line called Ryzen Threadripper, designed for high end desktops and workstations, with lines for enthusiast consumers and for enterprises with needs of more powerful workstations, such as performance seeking artists, architects, animators, and engineers. Besides these lines of processors, AMD also launched PRO versions of Ryzen and Ryzen Threadripper, aimed at the desktop and workstation business use, with more security and manageability support features that meet enterprise's needs. AMD also commercializes another family of processors - Athlon. Athlon was originally launched in 1999 and has suffered a lot of changes since then. Nowadays AMD sells Athlon processors as a more affordable APU for laptops, with Radeon graphics. This line was designed to compete with Intel's Pentium, meaning its processing power is lower than Ryzen processors, but targeting the more specific budget market. To satisfy the laptop/notebook market with a more ample range of products, AMD also offers a family of Ryzen APUs named Ryzen Mobile Series. Both Ryzen Mobile Series and Athlon Mobile Series have their own PRO versions aimed at business and commercial users, delivering a vaster set of security and manageability features. With all these different processor families, AMD has been able to create a range of products that meet different target audience's needs while keeping their prices competitive, allowing them to keep expanding and reaching a higher TAM.

The introduction of the Ryzen and Epic family and the revamp of Athlon line was only possible with the introduction of the Zen architecture in 2017. All these products were built originally with the first generation of Zen architecture, which was what set the ground for AMD's success in recent years. The introduction of Zen architecture marked the transition from 32nm nodes to 14nm, as well as greater multithreading performance, allowing AMD to reach the more profitable high-end CPU market. Since then, Zen architecture has kept on evolving with each generation, with the new Zen 4 set to release in 2022.

Regarding Graphics products, AMD labels its graphic card units (GPUs) under the brand "Radeon". Contrarily to the processor products, AMD bundles all GPU products in the Computing and Graphics Products segment instead of dividing between the consumer and business markets. Therefore, this division of the segment includes discrete GPUs for desktop and workstations for both personal consumers and professional users, as well as a Mobile Series (found in APUs, similarly to the computing products) for laptops and notebooks. For desktop personal users, AMD launched in the end of 2020 the RX 6000 series, as well as the Mobile version of the series in 2021 for laptop users.

The RX 6000 Series was launched with the new RDNA 2 architecture, in a new AMD's attempt to rival with Nvidia's latest Geforce 30 series. The new Radeon 6000 series GPUs, featuring RDNA 2 architecture, delivers up to twice the performance and 65% more performance per watt than the prior generation (RX 5000 series).

Similarly to the processing products, AMD offers a separate family for professional use, directed to business desktop and mobile workstations - the Radeon PRO, their most powerful graphic products. The Radeon PRO are also used in data center for cloud environments. For this data center market, AMD also offers the Radeon Instinct family of accelerators, used in deep learning training and traditional high performance computers (HPC) workloads. These GPUs are built to accelerate workloads in the scientific computing and AI markets and, according to AMD, are the world's fastest HPC accelerators for scientific research.

3.2.2. Enterprise, Embedded and Semi-custom

AMD's second segment addresses the markets of Server, Embedded, and custom designed system on chip computing devices. The server market is served with AMD's Epyc family of processors and the AMD Opteron X and A series. The Opteron X series is an APU designed for personal and small business use, whereas the Epyc family of processors are designed for high performance computing and cloud for modern data centers.

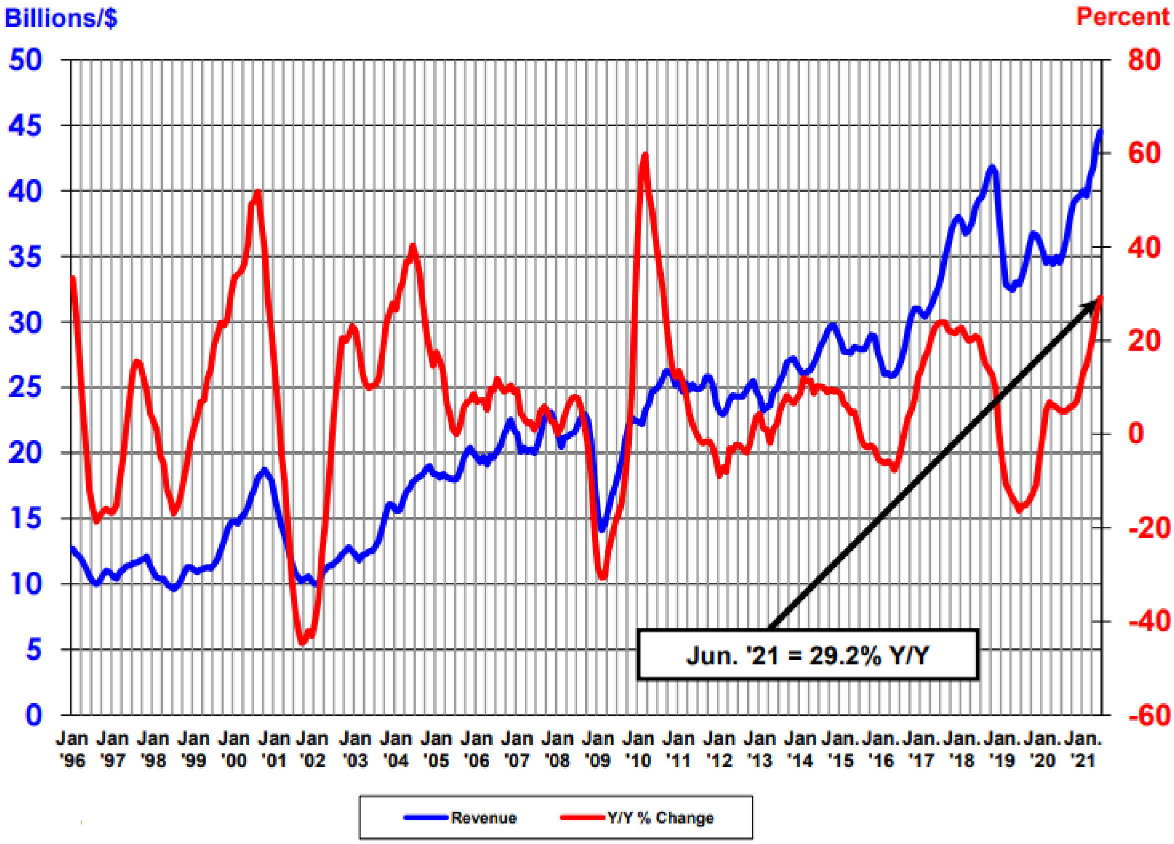
The embedded processors range of products include the Epyc Embedded family, Ryzen Embedded family, Embedded R-Series APUs, CPUs and SoCs, Embedded G-Series SoC platform and AMD Embedded Radeon GPUs.

The Semi-custom products from AMD are the SoC products developed for Sony and Microsoft, for both the third generation of consoles (PlayStation 4, Xbox One X, Xbox One S) and the fourth (PlayStation 5, Xbox Series X and Xbox Series S).

3.3. Industry Overview

In recent years, the semiconductor industry has been growing rapidly. In 2020, the global semiconductor sales were $440.4 billion, an increase of 6.5% compared to 2019. For the first and second quarter of 2021, sales were $123.1 and $133.6 billion, respectively. This represents an YoY increase of 17.8% for the first quarter, and 29.2% for the second. The forecasts for the full year of 2021 and ahead are very promising, as WSTS industry forecast reports project annual global sales will increase 19.7% in 2021 and 8.8% in 2022.

Figure 1. Worldwide Semiconductor Revenues, YoY% change



In 2020, the semiconductor industry faced a silicon shortage, which is still present today and it is expected to continue in 2022. This silicon shortage was mainly fuelled by the COVID-19 pandemic, which caused government-imposed lockdowns on many countries all over the world and disruptions on the supply chains. The impact was greatly noticed on the semiconductor industry, with an unanticipated rising demand for various essential areas in society, mostly due to people being forced to work remotely and take classes virtually, causing a spike of consumer devices consumption. At the same time, the supply declined abruptly, with factories being forced to shut down due to the pandemic's restrictions. This imbalance between the demand and supply was felt all over the world and exposed problems and vulnerabilities in the supply chains. Most of all, the shortage showed the importance that the semiconductor industry has on the world today. Nowadays almost everything that people use in their daily personal or professional activities has an electronic component, which requires a chip to process data and return an output to the user. Areas like communication, high performance computation for big amounts of data, and transportation all require powerful chips. In the automotive space, the semiconductors have set the grounds for smarter, safer, and more efficient electric cars. The COVID-19 pandemic has increased even more the demand in these areas, along with the development of the vaccine, which required the most powerful supercomputers available to process data and accelerate the development of the vaccine.

The imbalance between the supply and demand helps to explain why semiconductor sales only increased significantly in 2021 and not in 2020. Whereas in 2020 the demand was very high, the industry did not have an overall structure with efficient supply chains to meet that high demand. Even though there were investments made and the industry classified itself as “essential” so the factories could produce more, it was only in 2021 that we began to see the increases in production to increase the supply and meet the demand. Normally, the industry would run fab utilization on 80% of its total capacity. However, since the start of the pandemic, the fab utilization has surpassed 90% and its even set to go higher for the remaining year of 2021 to meet demand. There are also numerous investments being made to build new factories, one of which is AMD’s supplier for 7nm nodes - TSMC. TSMC has announced in 2020 its plans to build a new semiconductor fab in the United States. The construction is set to start in 2021, but the production will only start in 2024. These investments help the United States to regain some manufacturing capacity, in a time where most of the semiconductor manufacturing is concentrated in Asia. Despite being the market leader with almost 47% market share and the leader in R&D innovation, the US has fallen behind as a manufacturing location, with its manufacturing capacity having decreased from 37% in 1990, to 12% in 2021. This is due to the lack of investment the US government has made in the industry, whereas China on the other hand has done massive investments and it is set to command the largest share of global production by 2030. However, it seems the US government has taken notice of the need to invest in the industry, as in June 2021, the Senate passed the United States Innovation and Competition Act (USICA), which includes $52 billion to bolster domestic chip manufacturing, research, and design. In the future, this competition to attract more business on the semiconductor industry will heat up even more, as the most powerful and biggest economies in the world have realized the massive potential that semiconductors have, with uses on revolutionizing fields such as artificial intelligence, automotive space, advanced wireless networks, quantum computing, and more.

3.4. Financial Analysis

2020 was an outstanding year for AMD, with improvements on all financial key metrics. Net revenue increased 45% compared to 2019, gross margin increased from 43% to 45%. Operating income more than doubled, with an increase of 117% from $631 million in 2019 to $1,369 million in 2020. Net income in 2020 was $2,490 million, however, AMD released $1,301 million of its valuation allowance on deferred tax assets. Therefore, from an operating point of view, non-GAAP net income is more meaningful - Net income went up 108% from 2019 to $1,575 million. Furthermore, AMD improved its balance sheet in 2020, reducing outstanding principal debt from $563 million to $338 million, and increased cash, cash equivalents and short-term investments from $1.5 billion to $2.3 billion.

The enormous growth of revenue in 2020 is explained by an increase in both segments. In the Computing and Graphics segment, more clients adopted the use of Ryzen processors, increasing revenues by more than 50%. GPU and APU sales also increased significantly, helping to boost the segment. In Enterprise, Embedded and Semi-custom, adoption of Epyc processors also increased in HPC and cloud, with early shipments of the new generation of Epyc processors Milan helping to increase the server and data center revenues to new record highs. Semi-custom sales also helped to boost the EESC segment, with the success of PlayStation 5 and Xbox Series X and S being determinant for it.

For the first two quarters of 2021, AMD has already increased its gross margin to 48%. Revenue in the second quarter is up 99% YoY and 12% from the first quarter. The increase in revenues is again driven by both segments. In the Computing and Graphics segment, sales from Ryzen and Radeon products keep increasing and expanding market share. The mobile CPUs and APUs for notebooks also increased in average selling price and shipments. Data center graphics is also starting to ramp up on revenues with the newly launched Instinct accelerators. AMD expects its revenues to keep increasing until the end of 2021. Turning to the Enterprise, Embedded and Semi-custom segment, AMD keeps increasing revenues, driven by higher Epyc and semi-custom sales. Milan sales keep growing in 2021 and with this generation crossing over with the second generation of Epyc processors, server processors sales, cloud and HPC will boost massively for the remaining year of 2021. In fact, given how strong the first two quarters of 2021 were for AMD, and how the Company is improving its supply chain to meet demand, AMD updated its financial guidance metrics for the end of 2021, with all indicators improving. Revenue growth for 2021 is now expected to increase to 60% from 2020, and gross margin is expected to be 48%. However, one of the long-term goals of the Company is to have a gross margin higher than 50%, an accomplishment that may soon turn out to be real, with the Xilinx acquisition helping to improve the overall business gross margin. The company also expects operating expenses to decrease to 25% of revenues from 26% on previous guidance. Another great indicator of AMD’s momentum to become a leader in high performance computing was highlighted by the fact that the number of AMD-based systems on the latest top 500 list of the world's fastest supercomputers increased by almost 5x in the last year, and that EPYC processors power half of the 58 newly listed systems.

Overall, AMD is in a very healthy financial situation. The Company has been improving its balance sheet in the recent years mostly by increasing cash, cash equivalents and short-term investments. Although financial leverage decreased from 2019 to 2020, the decrease in debt was due to the conversion of its 2.125% convertible senior notes, to which the Company issued approximately 28 million shares of its common stock at the conversion price of $8.00 per share. The Company recorded a loss of $54 million from these conversions in Other expense, net on its consolidated statements of operations. In 2021, the remaining $26 million were converted in 2021 with the same conversion price and with a recorded loss of $6 million. From the DuPont analysis (appendix F), we can see the Return on Equity (ROE) decreased from 2019 to 2020. However, it is explained by the decrease in financial leverage. For 2021, financial leverage is still expected to decrease, but Return on Equity will increase, since the Net Profit Margin and Asset turnover increases will offset it. Therefore, from an operational point of view, AMD is improving, with higher margins and asset turnover. The Company has also been increasing its products share in the markets and boosting its sales. Since the beginning of the COVID-19 pandemic, AMD has also improved its supply chains each quarter to respond to the market demand, and it is set to continue to do so for the remaining year of 2021, which is what is allowing the Company to increase its guidance for the year and deliver more sales and revenues. For the next years, AMD's lower financial leverage and higher cash balances will allow for the opportunity to borrow more money to fund its growth if necessary.

Besides increasing its gross and operating margins, AMD has also been increasing net income, using its higher free cash flow to grow more into the future and return capital to shareholders via share repurchases. The free cash flow for the first two quarters of 2021 was $1.7 billion, an amount that is more than double the 2020 annual free cash flow of $777 million. Hence, in 2021, AMD announced a $4 billion stock repurchase program, to be carried over the next years, whenever the company sees good opportunities to buy back shares from the market.

3.5. Current and forward strategy

Most of the success AMD has been having in the recent years is due to the efficient execution of its roadmap planning, in which each new generation has been evolving over the previous one, releasing new and innovative products on the market, with clear competitive advantages that have guaranteed the success for AMD.

For both its segments, AMD plans to continue following their roadmaps. On their compute processing roadmap, AMD plans to release the next iteration of the ZEN architecture - ZEN 4, with the 5nm processor nodes. This release will be very important for the Company, since the Zen microprocessor families, Ryzen and Epic, are the most important products for the company and generate most of its earnings since the release of the first generation. A successful release for the next generation of ZEN 4 on both Ryzen and Epyc families will significantly boost the two segment revenues. In the second segment, "Enterprise, Embedded and Semi-custom", the next generation of Epyc processors with the Zen 4 architecture, Genoa, will have the 5nm processor node. Given AMD's intention to cement themselves as data market leaders for the future and expand this segment, the success of this release will be of great importance for the Company.

Another market segment where AMD wants to establish itself as a leader is on High Performance Computing (HPC). To achieve it, in 2020 AMD and Xilinx announced an agreement for AMD to acquire Xilinx in an all-stock transaction valued at $35 billion. The acquisition will greatly benefit both companies since their product portfolios and customers complement each other. Consequently, AMD's total addressable market will increase to $110 billion. The acquisition will also represent a 20% long term revenue compounded annual growth rate (CAGR), as well as increases on AMD's margins for gross profit and operating income. It will also be immediately accretive for EPS before synergies. The synergies for the future also represent huge advantages for the companies, with AMD able to utilize Xilinx Comms expertise and deep relationships and extend its CPUs into key embedded segments. Xilinx on the other hand will take advantage of AMD's strong relationships and EPYC momentum and accelerate its growth in the data center business.

AMD's CEO Dr. Lisa Su will lead the combined company as CEO. Xilinx President and CEO, Victor Peng, will join AMD as president responsible for the Xilinx business and strategic growth initiatives. Additionally, at least two Xilinx directors will join the AMD Board of Directors upon closing.

The acquisition was already approved by the boards and shareholders from both companies and is currently awaiting approvals and clearances required under the competition laws of foreign jurisdictions, being expected to be concluded until the end of 2021.

3.6. Corporate Governance

AMD's board of directors is constituted by eight members: Mr. John E. Caldwell, Ms. Nora M. Denzel, Mr. Mark Durcan, Mr. Michael P. Gregoire, Mr. Joseph A. Householder, Mr. John W. Marren, Dr. Lisa T. Su and Mr. Abhi Y (see appendix R). After analysing each board member, we can see that seven of the eight members are considered independent according to SEC and Nasdaq regulations. This means these members don't have a direct relationship with the Company that could affect their judgement and decisions as a director. Besides, the Company has stated on their Corporate Governance Principles document that the majority of independent directors should be the standard composition of the board and that the determination of independence for each member should be reviewed annually, thus avoiding future changes that could hurt shareholders.

The current chairman is independent and separate from the role of the CEO. However, the Company's corporate governance allows the roles to be occupied by the same person. In fact, it happened in 2004 when Hector Ruiz was both the CEO and executive chairman.

Regarding the executive compensation, AMD has the Compensation and Leadership Resources Committee, which designs and recommends the board on the compensation of its directors and the executive members of the company. The executives are compensated based on the performance of the company, with the CEO having only 6% fixed compensation, and the average of other named executive officers having 14%, whereas the rest is variable.

AMD's engagement with its shareholders is driven by 3 values: Accountability, Engagement and Transparency. One of the Company's main priorities is developing its ESG (Environmental, Social and Governance) focus through more transparency to its shareholders and target issues like product energy efficiency and climate, human capital management, supply chain responsibility, and the role of technology in society.

Regarding the risk management, AMD's board regularly receives reports from management about the operations, financial position & results, organization, and strategy of the Company. These are then analysed by each committee to assess the risk related to these topics so that the Board can discuss and provide feedback to the Company.

Overall, AMD's Corporate governance system is well designed and well enforced. The Company clearly strives to keep on improving its governance and become a better corporate citizen. All corporate governance documents and leadership team disclosure is clearly stated in their investor relations website, with documents such as its Principles of Corporate Governance laying the foundations for the present and future of its Corporate Governance. The information stated on this document helps to protect the Company's shareholders with guidelines like the policy of majority of independent directors on the board. Additionally, the board composition of 8 numbers is considered an appropriate number that allows the board to smoothly carry out its functions. All current directors of the board are highly qualified for the positions, with most having prior experience in the semiconductor industry. However, the principles of Corporate Governance document also states that the board can have up to 12 members, a scenario which could be seen as counterproductive. Also, the document states that the position of Chairman of the board and CEO can be occupied by the same person and that the board has experience of it functioning effectively either way. Although the Company has had this experience in the past, it is not an advised situation, and it is one that takes a lot of power from shareholders.

As analysed above, the Company's engagement with shareholders is also a very important topic for AMD and one which has been developed continuously. In 2020, AMD engaged with its shareholders to obtain feedback on topics such as: Board Composition; Environmental, Social and Corporate Governance Disclosures; Executive Compensation; Diversity and Inclusion and Pandemic-Related Business Continuity. The Company addressed the shareholders' feedback and made improvements on all these areas.

3.7. Competitors

3.7.1. Intel

Intel is AMD's biggest competitor on the Microprocessor and Chipset Market. Intel founded the x86 architecture that is the most widely used today in microprocessors, and also used by AMD processors. Intel is the market leader on overall x86 processors (both desktop and laptop/notebook) and server markets by a large difference. (See appendix S). As a result, Intel is able to control the market on the architecture standards and hurt AMD market's share, while also influencing manufacturers, distribution channels and customers. Besides, Intel has much more resources than AMD, with revenues in the latest fiscal year being 7x more than AMD's. However, as we can also see in appendix S, in the recent years, AMD has been increasing its market share on overall x86 and server processors market. The server market has seen the biggest increase, posing now as a great opportunity for AMD to expand their profits and business.

Intel also competes and dominates the embedded graphics processors and integrated graphics processor (IGP) chipsets market. This segment is growing rapidly, with APUs and now integrated graphics having a solid performance along with lower energy consumption, while posing as a cheaper option for many laptops and low to medium-end PC users. Moreover, the demand for APUs has also increased due to the inflated prices on discrete graphics, caused by the world's silicon shortage and the COVID-19 pandemic.

Intel has also announced that it is developing their own discrete graphics models, and given the company's prominent resources and position on the market, it can negatively impact AMD's market share on that segment.

On the manufacturing type, Intel is an IDM (integrated device manufacturer), meaning it has higher capital expenditures and R&D spending than many of its "fabless" competitors (like AMD). Another consequence of this is Intel's difficulty to produce more efficient chip nodes. Intel had some problems on the transition from 14 nm to 10 nm nodes and is yet to produce 7nm nodes like AMD already has. By outsourcing the chip production to TSMC, AMD was able to surpass Intel on this and build more efficient chips. Intel has announced on 23rd March 2021 that the 7nm processor node production is already in development.

3.7.2. Nvidia

Nvidia is the market share leader and main competitor of AMD in the discrete graphics market segment. Nvidia is, like AMD, fabless. This has allowed the company to direct its resources to improve the design of the hardware and develop technologies that enhance the GPUs' performance. One example of such is its deep learning super sampling (DLSS) technology, which renders frames on a low resolution, to then upscale them with the use of an AI model, developed by supercomputers. These innovations have allowed Nvidia to keep its clear leadership on the GPU market for consumer and professional users.

Another market segment where Nvidia competes with AMD is the server GPU market. In this market segment, the adoption of Nvidia's API CUDA on GPUs has conquered many admirers on high performance computing and machine learning, helping establish Nvidia's market share.

Nvidia also competes with AMD on the semi-custom market. However, in this market segment, AMD is the market leader. AMD's position here results from its close relation to their customers Sony and Microsoft in producing the semi-custom products tailored for each console's requirements.

Nowadays, Nvidia was able to develop from a GPU producer company to a preeminent hub on machine learning and artificial intelligence. In 2020, Nvidia announced the intention to acquire ARM Holdings, in what would be the "the premier computing company for the age of AI". This merger would further expand Nvidia plans on the machine learning and AI field, presenting a huge threat to any competitor. The merger has been stalled over investigations of competition concerns by EU and UK competition authorities. This merger would help fund and develop the ARM ecosystem, presenting a huge threat in the future to AMD.

3.7.3. Texas Instruments

Texas Instruments is not an AMD's competitor as direct as Intel or Nvidia, however, it is still worth mentioning, especially if AMD's acquisition of Xilinx follows through.

Texas Instruments competes with AMD specifically on the Embedded processing products and data center markets. However, Xilinx competes with Texas Instruments on more market segments like automotive, industrial, aerospace & defence and consumer markets. With the acquisition of Xilinx from

AMD, all activities are absorbed by AMD, making Texas Instruments a more direct competitor to AMD's operations.

3.7.4. Qualcomm

Similarly to Texas Instruments, Qualcomm does not currently compete directly with AMD on AMD's most predominant market segments. Qualcomm's main source of revenue is from its QCT segment, where it sells integrated circuit products such as the Snapdragon family. The Snapdragon family of processors are available for platforms such as mobile, compute, sound and automotive. For its competition with AMD, the main particularity that stands out from these products are its design using ARM architecture, making Qualcomm a big company that supports the rise of the ARM ecosystem in the industry, and consequently posing as a threat for AMD in the future.

In March 2021, Qualcomm completed the acquisition of Nuvia for $1.1 billion. This new division allows Qualcomm to expand into the CPU and GPU markets for PCs, acquiring a team with expertise in high performance processors, SoC (system-on-chip) and power management for compute-intensive devices and applications. Therefore, in the next years Qualcomm will certainly become a bigger competitor for Intel, AMD and Nvidia, presenting themselves as a threat by creating new products and pushing the ARM architecture to become the industry standard.

3.8. Risk factors

Appendix T shows a risk matrix that summarizes the impact and probability of the following risk factors.

3.8.1. Economic and Strategic Risks (ERR)

1. *Intel Corporation's dominance of the microprocessor market and its aggressive business practices may limit AMD's ability to compete on the same level as its peers.*

   Intel has founded the x86 architecture and has been the market leader for microprocessors for a long time. The influence that it has over the market is very dangerous for AMD, as Intel is able to drive the de facto standards of the industry on the x86 microarchitecture, while also targeting AMD's customers, channel distributors and partners. This influence can negatively affect AMD's sales for the future on the segment.

Besides, Intel is a much bigger company than AMD, with a lot more financial and structural resources, which can be used to leverage its innovation and bring powerful products earlier to the market, putting AMD in a position that would require larger investments in R&D to compete with.

2. *High competition in the market.*

The semiconductors industry is a very competitive industry with new products being released often to the market. One of the reasons is Moore's law, which states that the number of transistors in an integrated circuit (IC) doubles about every two years. This means that new and more powerful chips are constantly set to enter the market, and if companies do not keep up with it and develop their products, they may get left behind.

Additionally, AMD's main competitors Intel and Nvidia, are set to enter the discrete GPU market and the HPC market segment, respectively. This will dictate more competition from big companies in more markets, which may negatively impact AMD's market share on these segments.

3.8.2. Operational and Technology Risks (OTR)

1. *AMD's fabless manufacturing type.*

Being a fabless company, AMD relies on third parties to manufacture its products, meaning it is dependent on those companies' ability to deliver the products on time, with sufficient quantities and using competitive technologies.

2. *Revenues from semi-custom SoC products are dependent on the success of AMD's clients and the products that they are incorporated in.*

Sony and Microsoft are AMD's biggest clients for semi-custom SoC products, however, the success of their newly released PlayStation 5 and Xbox Series S and X will determine if the sales grow more in the future, meaning more units that need to be produced and more revenue for AMD. If the consoles are not as successful as the companies forecast, AMD will not produce and ship as many units and miss out on many revenues.

3. *Compatibility with the industry-standard software and hardware.*

The most widely used and known microprocessor architecture is the x86 microarchitecture. However, in recent years some companies have developed ARM-based microprocessors and platforms. If more companies in the industry start to use ARM architecture for microprocessors and the industry-standard changes, AMD will be negatively impacted, since it only produces x86 microprocessors. The further growth and development of the ARM ecosystem may mean a huge loss of clients and market share for the future. If Nvidia is able to finalize the acquisition of ARM and invest to fuel the growth of its architecture, the consequences for AMD are even worse, meaning with will not only have to deal with the growth of the ARM architecture ecosystem, but also with the growth of a huge competitor in the market and its ability to deliver new and innovative products earlier.

3.8.3. Legal and Regulatory Risks (LRR)

1. *Possible lox of tax incentives.*

In 2020, AMD released a portion of its valuation allowance change. The Company still has approximately $1.6 billion of valuation allowance change recorded in its deferred tax assets and if it cannot realize it in the near future, their operations results would be adversely affected.

3.8.4. Xilinx Merger and Acquisition Risks (XMAR)

1. *Failure to complete Xilinx acquisition.*

With the Xilinx acquisition in its final stage, it is set to be concluded by the end of 2021. The acquisition is awaiting approvals and clearances required under the competition laws of foreign jurisdictions. If for some reason the acquisition falls through, it will impact AMD negatively and may adversely affect its stock price. Besides, AMD is also required to pay a termination fee of $1.5 billion if the agreement is terminated by AMD’s decision.

3.8.5. General Risks (GR)

1. *AMD’s stock price is subject to high volatility.*

AMD’s stock price has soared 77% since the beginning of 2020 until the end of the second quarter 2021. The stock price particularly sees more fluctuations before and after earnings release. According to AMD, these fluctuations could impact the value of their equity compensation, thus affecting their ability to recruit and retain employees, and negatively impacting their business and financing opportunities.

4. Valuation

4.1. Methodology

To evaluate if AMD's share price is currently trading at a premium or discount it is performed a discounted cash flows (DCF) analysis in the following points, with both a perpetuity approach and an exit EBITDA multiple approach. To confirm and check the results from the DCF analysis, it is also performed a relative valuation analysis by studying the most significant multiples of the company and its peers.

4.2. Financial Forecasts and assumptions

4.2.1. Revenue forecasts

To forecast revenues, I followed AMD's financial guidance for the remaining year of 2021, which forecasts an increase of total revenue by 60% YoY compared to 2020. Combined with the Company's forecast of $4.1 billion for the third quarter, we have the complete revenue forecasts for 2021. For the following years, "Computing and Graphics" segment is expected to grow at 10% each year, whereas "Enterprise, Embedded and Semi-Custom" segment is expected to grow at 26% (see appendix D). These growth rates yield total revenues in line with the revenues forecast consensus from analysts in the industry.

For the segment revenue forecast, it is important to investigate each segment separately and how they are growing in the company, since the product mix is expected to change in the next years according to AMD's strategy to boost data center. AMD's second segment Enterprise, Embedded and Semi-Custom has recently increased its percentage of the total revenues due to the success of Epyc's third generation Milan, as well as a ramp up in the cloud and HPC segments. This growth is expected to continue in the future, with the new generation of Epyc processors Genoa to be launched in 2022 and the crossover with the previous generations, in addition to an increase in shipments of semi-custom SoC products due to higher console's sales. Therefore, the forecast for EESC percentage of total sales is to gradually grow each year and reach approximately 50% by 2025 (see appendix D).

4.2.2. Margins

AMD's financial guidance also provided forecasts for its operational margins. Gross profit margin for the full year of 2021 is expected to be 48%, with the long-term goal to increase further from 50%. If

AMD is able to finalize the Xilinx acquisition as it expects, its gross margin will instantly increase to more than 50%.

Operating expenses margin is expected to be 25% of revenues. Following the historical weight of R&D margin as 65% of total operating expenses and the remaining 35% for SG&A for the future, the forecasts for 2021 give the results 16,3% for R&D margin, and 8,8% for SG&A margin.

For the tax rate, AMD pays the statutory 21% federal income tax rate. However, due to some adjustments, for 2021, AMD's guidance predicts tax rate to be around 15%. The forecast for the next years is the straight-line of 15%, with 21% as the long-term tax rate. The appendix E shows a summary of all growth rates and margins.

4.2.3. Working Capital

For the working capital, all items were straight lined based on the 2020 indicators. In 2020, AR as a percentage of sales was 21,6% and days sales outstanding was 77. Since AR will grow with revenues, they were forecasted using AR percentage of sales as the explicit driver.

For accounts payable and inventories, the same methodology was used but by growing them with cost of goods sold and using the AP as a percentage of COGS as the explicit driver, while maintaining Days payable outstanding and inventory turnover steady.

Accrued expenses were forecasted similarly to AR since they can be all tied to operations and will grow with revenue. Appendix G shows all working capital items forecasts.

4.2.4. Property, Plant & Equipment (PP&E)

As a growing company, AMD has been investing considerably on purchases of property and equipment. Based on the first half of 2021 and the company's guidance, AMD is expected to have a slight decrease in capital expenditures when compared to 2019 and 2020. Therefore, the Company is forecasted to have capital expenditures (Capex) growing with revenue as the driver at 2%.

Depreciation will grow along capital expenditures, and since AMD's depreciation as a percentage of capital expenditures in the last 3 years has fluctuated, the following years' forecast was calculated as an average of the last 3 years (65,6%). Appendix H shows the detailed PP&E forecast.

4.2.5. Other assets/ Liabilities, Deferred Tax assets and Intangible assets

Other assets, Deferred Tax assets and other current liabilities cannot be tied to AMD's operations and the Company does not disclose any useful information to accurately forecast them for the future and, therefore, they are straight lined with the 2020 amount. For Intangible assets (including Goodwill) AMD also does not disclose any information and so there are no forecasts of any purchases in the future. However, for other non-current liabilities, AMD discloses its fixed payments for the future. Prepaid expenses and other current assets (not including Receivables from related parties) can be tied to AMD's operations and so it is forecasted with sales growth, with an average of its total percentage from sales from the years 2019 and 2020. Appendix I shows the detailed forecast for other assets/ Liabilities and Deferred Tax assets.

4.2.6. Operating leases

Operating lease assets and liabilities recorded were forecasted using capital expenditures as the driver. AMD will continue to renew its operating leases to carry on with its operations, and with higher revenues and capital expenditures in the future, the Company will also need to expand its operating leases. The detailed forecast for operating leases is presented on appendix J.

4.2.7. Capital stock

AMD is expected to continue with its stock-based compensation program, and the driver chosen to grow the stock-based compensation was operating expenses. The Company will most likely maintain stock-based compensation at a stable percentage of operating expenses as it grows its operations and expenses. The forecast of 2,9% of total operating expenses is an average from 2018 to 2020 numbers. AMD does not disclose any information on new shares to be issued, hence its forecast to 0 for the future.

Regarding Treasury Stock, AMD has announced in 2021 a stock repurchase program of up to $4 billion and has already bought shares in the first half of 2021 in the amount of $256 million, thus it can be forecasted to continue buying up to $4 billion for the coming years. Appendix K shows the detailed forecast for capital stock.

4.2.8. Debt

AMD's debt is currently mainly constituted on its 7.50% senior notes. In the first half of 2021, $25 million were converted from the 2.125% convertible senior notes, leaving the company with only $1 million principal outstanding on these notes, and with $312 principal on its 7.50% senior notes. This means the current capital structure of AMD is only 5,35% of debt to capital. This amount of debt is small and although the senior notes that constitute it are due in 2022, it is not reasonable to assume the company will paydown this debt and not borrow more, as having no leverage would put them at a competitive disadvantage to its peers and limit its future growth. Therefore, the assumption is that AMD will maintain its capital structure of approximately 5.35%, continuing to borrow as its equity grows. Appendix L shows the detailed forecast of debt.

4.2.9. Shares outstanding

AMD's shares outstanding will decrease with the repurchase program being executed. The number of shares that will be repurchased will depend on the price of the shares at the time of the buy back and it is not possible to predict that price, as the market will fluctuate a lot and the company will repurchase only when it sees a good opportunity to do it. Therefore, a good estimate is to forecast the average share price based on the consensus non-GAAP EPS from analysts in the industry. Appendix M shows the detailed forecast of shares outstanding.

4.3. Beta

AMD's 5-year observed beta calculated from linear regression is 1.32. However, for the weighted average cost of capital (WACC) calculation I opted to calculate the beta using comparable companies. The levered beta calculation was done by unlevering the observed 5-year betas from AMD and its peers in the industry to obtain the industry average unlevered beta, and then re-lever that average industry beta for AMD, as observed in the following table:

Table 1. Beta Calculation

BETA CALCULATION								
	Observed b	**Share price**	**Dil. shares**	**Market cap**	**Cash**	**Debt**	**Tax rate**	**Delev. b**
INTC	0,99	57,48	4 090,0	235 093	36 329	35 409	12,7%	0,99
NVDA	1,39	199,85	2 529,0	505 421	19 654	11 943	3,4%	1,41
TXN	0,95	191,53	936,0	179 272	7 390	6 251	14,0%	0,96
QCOM	1,03	139,72	1 151,0	160 818	12 907	15 740	10,6%	1,01
AMD	1,32	105,80	1 230,774	130 216	3 860	313	21,0%	1,35
Industry average delevered beta	**1,14**							
AMD beta	**1,12**							

4.4. WACC

For the cost of equity calculation, the method used was the capital asset pricing model (CAPM). The risk-free rate considered is the yield on the 10-year treasury bonds (value as of October 13, 2021). As for the expected market return, it was calculated as the average annual return on the last 20 years of the S&P 500, since it is a good proxy for the expected return on the American market. These values generate a market risk premium of 5.89%, and along with the industry average levered beta of 1.12, a cost of equity equal to 7,9%

As for the cost of debt, it was considered the interest rate on the 7.50% senior notes, since after the first half of 2021 AMD's debt is mainly composed of them.

The following table shows the summarized values for the calculation of WACC:

Table 2. Cost of Capital Assumptions

COST OF CAPITAL ASSUMPTIONS		
Cost of debt		7,50%
Tax rate		21,0%
After tax cost of debt		5,9%
Risk free rate		1,55%
Beta		1,12
Market risk premium		5,71%
Cost of equity		7,9%
Capital weights		
	Amount	% of total
Market value of equity	130 215,9	102,8%
Market value of Net debt	(3 546,5)	(2,8%)
Cost of capital (WACC)		**8,00%**

4.5. Free Cash Flow to the Firm

The free cash flow to the firm calculation starts by taking EBIT and subtracting EBIT * (1 - tax rate) to arrive at the earnings before interest after taxes (EBIAT), or net operating profit after taxes (NOPAT). Using EBIT * (1 - tax rate) instead of the amount of taxes paid avoids the double counting of the interest expense tax shield captured in the cost of debt part of WACC.

There are then adjustments to be made to EBIAT to arrive at cash from operations and unlevered free cash flow afterwards, such as adding depreciation and amortization, subtracting increases in working capital assets, adding increases in working capital liabilities and subtracting capital expenditures and other required investments. The appendix N displays the unlevered free cash flow to the firm detailed calculation.

4.6. Enterprise value

To find the fair value per share of AMD there are two approaches being used: the perpetuity approach and the exit EBITDA multiple approach. Each approach's results will be used to verify the other and confirm the calculations of the equity value per share of AMD.

To calculate the enterprise value needed for both approaches, it is first necessary to calculate the present value of the unlevered free cash flows to the firm. The discount factor "t" is based on the time into 2021 that the analysis is being made. To add to that, it is also considered that the cash flows are being generated at the middle of the year instead of the end, since cash flows are constantly being generated and assuming an end of period would not provide a value as reliable as the middle of period. The mid-period adjustment factor calculated is 103.9%.

Table 3. Discount factor t

Discount factor *t*	27%	127%	227%	327%	427%
	0,27	1,0	1,0	1,0	1,0
Present value of Unlevered FCF	**2 356**	**3 650**	**4 040**	**4 362**	**4 409**

4.7. Perpetuity approach

As already mentioned in the literature review section, enterprise value through the free cash flow to the firm is calculated with the formula (6):

$$Firm\ Value = \sum_{t=1}^{t=n} \frac{FCFF_t}{(1 + WACC)^t} + \frac{TV_n}{(1 + WACC)^n}$$

First, one more significant adjustment to be made is to "normalize" the free cash flows of the last forecast period. To normalize them, depreciation & amortization and capital expenditures are excluded, since in perpetuity the company will not grow forever and have Capex > D&A. In perpetuity, the ratio should be close to 1 as the company will only have capital expenditures to maintain itself and not to grow. Therefore, these two items can be excluded from the FCFF calculation as they will most likely offset each other in the future.

As for the long-term growth rate needed to calculate terminal value (TVn), the rate chosen of 4% is justified by the high inflation in the international and US markets, which according to Fed's estimates in September should only drop to 2.2% in 2022. The key assumption to be made here is that AMD will, at the very least, grow more than inflation. The 4% is therefore a good balance between the higher inflation in the coming years and the growth that the company can expect to see in an evolving industry like the semiconductors is.

Summing the present value of terminal value and the present value of stage 1 cash flows already calculated, the enterprise value through the perpetuity approach amounts to $137,436.69 million.

Table 4. EV through Perpetuity approach

PERPETUITY APPROACH	
Normalized FCF in last forecast period (t)	6 097
Normalized FCFt+1	6 341
Long term growth rate (g)	4,0%
Terminal value	164 742
Present value of terminal value	118 605
Present value of stage 1 cash flows	18 817
Enterprise value	**137 421,79**
Implied TV exit EBITDA multiple	*18,756x*

4.8. Exit EBITDA multiple approach

For the Exit EBITDA multiple approach, the calculations are more straightforward. The terminal value is calculated by taking the terminal year EBITDA (8,783 million) and multiplying it by terminal value EBITDA multiple or exit EBITDA multiple. The multiple chosen here is a comparable companies derived EV/EBITDA multiple from AMD's industry, since the other option, a last twelve months EV/EBITDA from AMD, is too high due to the high growth of the Company's EBITDA in the last year. Therefore, the comps derived exit EBITDA multiple yields a more sensible terminal value for the approach. Finally, the terminal value is calculated, and its present value is added to the present value of stage 1 cash flows already mentioned, giving $125,685 million as the result for the enterprise value from the exit EBITDA multiple approach.

Table 5. EV through exit EBITDA multiple approach

EXIT EBITDA MULTIPLE APPROACH	
Terminal year EBITDA	8 783
Terminal value EBITDA multiple	16,9x
Terminal value	148 437
Present value of terminal value	106 866
Present value of stage 1 cash flows	18 817
Enterprise value	**125 683**
Implied TV perpetual growth rate	*3,579%*

4.9. DCF results - Scenario and Sensitivity analysis

Given the perpetuity and exit EBITDA multiple approach, the fair value per share summary calculation is as follows:

FAIR VALUE PER SHARE		
	Perpetuity	EBITDA
Enterprise value	137 422	125 683
Less: Net debt	3 547	3 547
Equity value	**140 968**	**129 230**
Diluted shares	1 231	1 231
Equity value per share	**$114,54**	**$105,00**
Market premium / (discount) to fair value	(7,6%)	0,8%

The DCF analysis has some key independent variables that impact its final results considerably, such as the weighted average cost of capital, the long-term growth rate, and the exit EBITDA multiple. Since these key variables are all dependent on the assumptions made in the model, it is important to analyse how their variation affects the final results with a sensitivity analysis. The appendix O shows the sensitivity analysis tables.

Expectedly, the long-term growth rate and EBITDA multiple have the most impact on the equity value per share. However, it is important to note from the third table that with a 15% higher terminal EBITDA value the fair share price would already be at a discount without changing the 16.9x comps derived terminal EBITDA multiple. The following football field chart helps to get a better overall view on the DCF results:

Figure 2. Football field chart

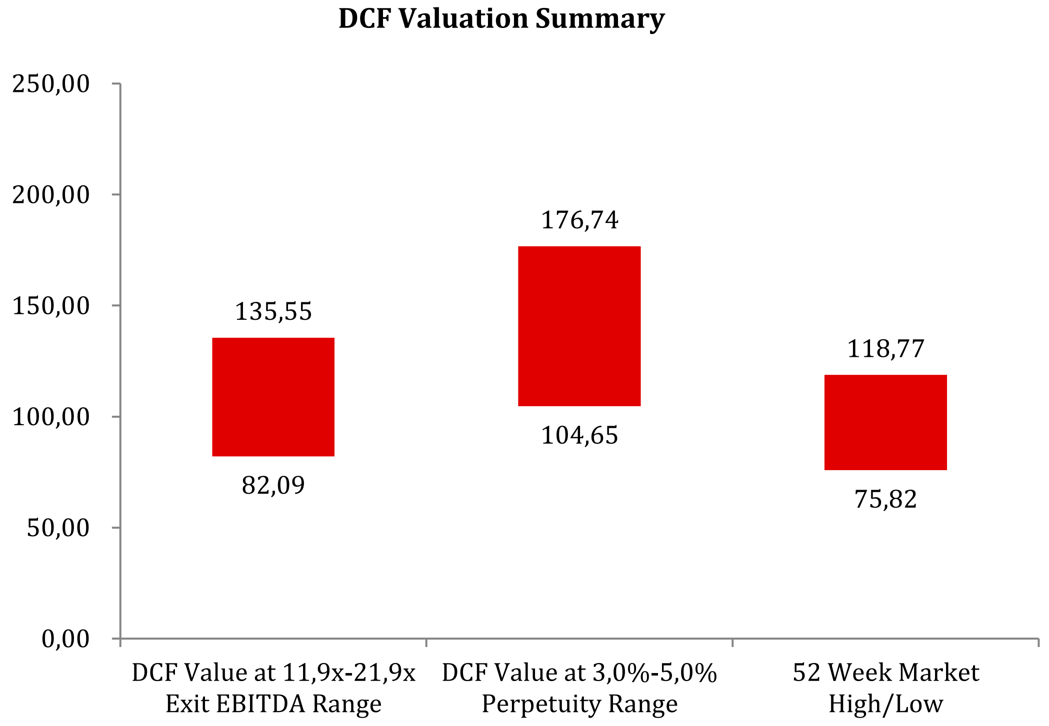


Table 6. Football Field range

	Low	Diff.	High
DCF Value at 11,9x-21,9x Exit EBITDA Range	108,04	74,75	182,79
DCF Value at 3,0%-5,0% Perpetuity Range	129,85	92,62	222,47
52 Week Market High/Low	75,82	42,95	118,77

For a scenario analysis, it is important to analyse the impact that the Xilinx acquisition will have on AMD. Therefore, the acquisition scenario was chosen instead of an analysis of a "best case" scenario for AMD. The acquisition will be done as an all-stock transaction, with each Xilinx shareholder receiving 1.7234 shares of AMD for each Xilinx's share they own. AMD will then issue shares to pay for the transaction, creating dilution for its shareholders. On the other hand, AMD will acquire all Xilinx's assets and liabilities and strengthen its balance sheet. AMD's gross profit margin, EPS and cash flows will be immediately accretive. The company's guidance shows a 19.6% long-term revenue CAGR, bringing 2022 revenues forecast to $21,977 million, an increase of 38,4% compared to 2021. The gross profit margin will increase to a combined 55% since Xilinx has a much higher gross profit margin of 68.4%. On the other hand, R&D and SG&A margins increase with the acquisition, since Xilinx last reported R&D and SG&A Non-GAAP margins of 29,34% and 15.76% respectively, higher numbers than

AMD's current ones. All combined margins were computed as a weighted average with the weights of 74% for AMD and 26% for Xilinx. The following table summarizes the changes for the Xilinx acquisition scenario:

Table 7. Scenario Analysis margins

SCENARIO ANALYSIS					
Fiscal year	**2021P**	**2022P**	**2023P**	**2024P**	**2025P**
Revenue growth	65,0%	36,4%	21,6%	26,8%	32,9%
Gross profit as % of sales	49,0%	55,0%	55,8%	56,8%	57,8%
R&D margin	15,3%	19,7%	19,7%	19,7%	19,7%
SG&A margin	7,8%	10,6%	10,6%	10,6%	10,6%

The fair value per share for the Xilinx acquisition scenario is detailed in the following table:

Table 8. Scenario analysis fair share price

FAIR VALUE PER SHARE		
	Perpetuity	EBITDA
Enterprise value	199 343	193 148
Less: Net debt	4 936	4 936
Equity value	**204 279**	**198 085**
Diluted shares	1 657	1 657
Equity value per share	**$123,29**	**$119,56**
Market premium / (discount) to fair value	(14,2%)	(11,5%)

4.10. Relative Valuation – multiples

4.10.1. Peer group analysis

The peer group chosen for the comparable companies' analysis is composed of 5 companies - AMD, Intel, Nvidia, Qualcomm and Texas Instruments. The table in appendix P summarizes the peer group.

The criteria chosen for the selection of the peer group were the similarity of products/ business, manufacturer type and market cap. Intel and Nvidia are the most direct competitors to AMD according to the Company's 10-K and 10-Q filings. Therefore, its inclusion in the peer group is straightforward. As for the four remaining companies, Micron technology is the least similar to AMD in products sold, making it the first exclusion from the group. Although Qualcomm, Texas Instruments and Broadcom all sell relatively similar products to AMD, the decision to include Qualcomm and Texas Instruments is justified by AMD's acquisition of Xilinx, since these companies' products are much more similar to the ones produced by Xilinx, and after the merger is completed there will be more direct competition. Broadcom on the other hand competes with AMD but only on a small portion of its market segments. Broadcom's main revenue source is from segments in which it doesn't compete with AMD. Besides, Broadcom's market cap is the highest between these companies, making it a bigger outlier and resulting in its exclusion from the group.

4.10.2. Multiples model and analysis

With the peer group selected, the multiples picked to be analysed in the group are: EV/Revenues, EV/EBITDA, EV/EBIT and P/E.

The following table displays the trailing and forward multiples for the peer group:

Table 9. Trailing and forward multiples of the peer group

		Last Twelve Months (LTM)				Year 1 Forecast - Calendar Year				Year 2 Forecast - Calendar Year				
Name	Ticker	EV/ Revenues	EV/ EBITDA	EV/ EBIT	P/E	EV/ Revenues	EV/ EBITDA	EV/ EBIT	P/E	EV/ Revenues	EV/ EBITDA	EV/ EBIT	P/E	PEG ratio
Advanced Micro Devices	AMD	9,5	39,1	44,1	50,8	8,1	30,5	35,2	42,8	6,9	24,3	27,7	33,4	1,6
Intel Corporation	INTC	3,0	5,5	9,7	10,6	9,1	22,1	19,6	14,1	8,1	19,9	17,3	12,6	0,6
Nvidia	NVDA	22,7	45,8	51,3	57,9	7,2	16,7	24,9	43,5	6,8	15,4	24,3	44,8	10,3
Qualcomm	QCOM	5,0	13,8	15,7	18,8	4,8	12,5	13,8	16,4	4,4	11,6	12,5	14,9	0,7
Texas Instruments Inc.	TXN	10,6	20,8	23,5	26,7	9,9	18,9	20,9	23,9	9,5	18,4	20,1	23,1	2,3

Given the high discrepancies of Nvidia compared to the rest of the group, the company was selected as an outlier and excluded from the analysis to avoid any bias in the calculation. With the Nvidia exclusion the values for the average, median, high, and low multiples of the peer group are as follows:

Table 10. Statistical comparison of the multiples of the peer group

	Last Twelve Months (LTM)				Year 1 Forecast - Calendar Year				Year 2 Forecast - Calendar Year				
	EV/ Revenues	EV/ EBITDA	EV/ EBIT	P/E	EV/ Revenues	EV/ EBITDA	EV/ EBIT	P/E	EV/ Revenues	EV/ EBITDA	EV/ EBIT	P/E	PEG ratio
High	10,6x	39,1x	44,1x	50,8x	9,9x	30,5x	35,2x	42,8x	9,5x	24,3x	27,7x	33,4x	2,3x
Low	3,0	5,5	9,7	10,6	4,8	12,5	13,8	14,1	4,4	11,6	12,5	12,6	0,6
Median	7,3	17,3	19,6	22,7	8,6	20,5	20,3	20,1	7,5	19,1	18,7	19,0	1,1
Mean	**7,0**	**19,8**	**23,2**	**26,7**	**8,0**	**21,0**	**22,4**	**24,3**	**7,2**	**18,6**	**19,4**	**21,0**	**1,3**
Mean (excl. AMD)	**6,2**	**13,4**	**16,3**	**18,7**	**7,9**	**17,8**	**18,1**	**18,1**	**7,3**	**16,6**	**16,6**	**16,9**	**1,2**
AMD	**9,5**	**39,1**	**44,1**	**50,8**	**8,1**	**30,5**	**35,2**	**42,8**	**6,9**	**24,3**	**27,7**	**33,4**	**1,6**

The first thing to notice in these results is the big difference between AMD's trailing and forward looking multiples. The higher values on the trailing multiples are explained by the high growth the Company has seen in the last 12 month, meaning the forward looking multiples provide a better range of values to analyse. However, even AMD's forward looking multiples like EV/EBITDA and EV/EBIT are much higher than the industry's, which is explained by the high growth expectations investors have for AMD.

With these results it can be assembled a valuation matrix that reflects the fair value per share for each metric (see appendix Q)

4.11. Valuation results and recommendation

The relative valuation through multiples analysis revealed high multiples for AMD compared to the industry's average, which translates into a lower fair share price compared to the price on the market. Although these results can indicate the company is overvalued in the market, they can also be explained by the high growth expectations the market has for AMD. The investors are willing to pay a higher price for AMD given its future growth expectations and if AMD can increase its revenues, margins, and earnings then the higher multiple might not be a problem. Despite that, all multiples showed results that do not match with the DCF analysis. Whereas the DCF results through the perpetuity and EBITDA approach showed a fair equity value per share of $114.57 and $105 respectively, the multiples analysis only showed an amount higher than $100 on the forward looking median EV/Revenues multiple. All other median multiples showed a fair share price under $85, which would translate into a "sell" recommendation. However, as already explained, these results are explained from the fact that AMD has seen a very high growth recently, whereas its peers in the industry didn't. Although the peer group selected is the most similar to AMD in its core business inside the industry, these differences showed that it is not an adequate comparable group. Therefore, the DCF analysis carries more weight into the final recommendation.

The fair share prices that resulted from the DCF analysis were compared to the current stock price as of September 24th, 2021 - $105.80. Although the fair share price from the DCF showed that AMD is correctly valued in the market with only the perpetuity approach having a discount of 7.6%, the Xilinx acquisition scenario showed a higher fair share price at $123.29 for the perpetuity approach and $119.56 for the exit EBITDA multiple approach, representing upsides of 14.2% and 11.5% respectively. The acquisition is in its final stages and has already been approved by shareholders from both companies and boards and is only waiting for approvals from regulating entities. With the progress that was made in 2021 and the outlook given by the company in the second quarter that confirms its expectation to conclude the operation by the end of the year, its conclusion can be seen as the most likely outcome and therefore its importance increases. Besides that, the analysis of the acquisition made did not consider the COGS and operating expenses synergies created, and the opportunities for AMD to break into new markets and solidify its share in the current ones. As a result, the future is bright for AMD as the company has a lot of opportunities to grow in an industry that is also set to substantially grow and have massive importance to the world. For all that, the recommendation for AMD is to “Buy”.

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6. Appendixes

Appendix A – Income Statement

INCOME STATEMENT								
Fiscal year	2018A	2019A	2020A	2021P	2022P	2023P	2024P	2025P
Revenue	6 475	6 731	9 763	15 621	18 248	21 461	25 275	29 806
Cost of sales	(4 028)	(3 863)	(5 416)	(8 123)	(9 124)	(10 516)	(12 385)	(14 605)
Gross Profit	**2 447**	**2 868**	**4 347**	**7 498**	**9 124**	**10 945**	**12 890**	**15 201**
Research & development	(1 434)	(1 547)	(1 983)	(2 538)	(2 965)	(3 487)	(4 107)	(4 844)
Selling, general & administrative	(562)	(750)	(995)	(1 367)	(1 597)	(1 878)	(2 212)	(2 608)
Licensing gain	–	60	–	(5)	–	–	–	–
Operating profit (EBIT)	**451**	**631**	**1 369**	**3 588**	**4 562**	**5 580**	**6 571**	**7 750**
Interest income	18	15	8	13	22	36	53	75
Interest expense	(121)	(94)	(47)	(28)	(37)	(52)	(69)	(92)
Other expense	(18)	(180)	(55)	(11)	–	–	–	–
Pretax profit	**330**	**372**	**1 275**	**3 561**	**4 546**	**5 564**	**6 555**	**7 733**
Taxes	9	(31)	1 210	(534)	(682)	(835)	(983)	(1 624)
Equity Income (loss)	(2)	–	5	–	–	–	–	–
Net income	**337**	**341**	**2 490**	**3 027**	**3 864**	**4 729**	**5 572**	**6 109**
Basic shares outstanding	982	1 091	1 184	1 207	1 200	1 194	1 190	1 188
Impact of dilutive securities	82	29	23	23	23	23	23	23
Diluted shares outstanding	1 064	1 120	1 207	1 230	1 223	1 217	1 213	1 211
Basic EPS	$0,34	$0,31	$2,10	$2,51	$3,22	$3,96	$4,68	$5,14
Diluted EPS	**$0,32**	**$0,30**	**$2,06**	**$2,46**	**$3,16**	**$3,88**	**$4,59**	**$5,04**

Appendix B – Balance Sheet

BALANCE SHEET							
Fiscal year	**2019A**	**2020A**	**2021P**	**2022P**	**2023P**	**2024P**	**2025P**
Cash & equivalents ST & LT market. securities	1 561	2 353	3 798	6 822	10 650	15 294	21 515
Accounts receivable	1 859	2 066	3 306	3 862	4 542	5 349	6 307
Inventory	982	1 399	2 098	2 357	2 716	3 199	3 773
Deferred tax assets	22	1 245	1 245	1 245	1 245	1 245	1 245
Other current assets (inc. Receivables from related parties)	253	388	583	679	797	937	1 103
Property, plant & equipment	500	641	748	874	1 021	1 195	1 400
Acquired intangible assets (inc. Goodwill)	289	289	289	289	289	289	289
Operating lease right-of-use assets	205	208	221	258	304	358	422
Other assets	357	373	509	509	509	509	509
Total assets	**6 028**	**8 962**	**12 797**	**16 894**	**22 073**	**28 374**	**36 563**
Accounts payable	988	468	702	788	909	1 070	1 262
Accrued liabilities	1 084	1 796	2 874	3 357	3 948	4 650	5 483
Other current liabilities (inc. Payables from related parties)	287	153	145	145	145	145	145
Long-term operating lease liabilities	199	201	214	250	293	346	408
Revolver	–	–	0	0	0	0	0
Long term debt	486	330	416	581	794	1 053	1 395
Other non-current liabilities	157	177	232	296	315	325	333
Total liabilities	**3 201**	**3 125**	**4 582**	**5 417**	**6 404**	**7 588**	**9 025**
Common stock / additional paid in capital	9 975	10 556	10 906	11 305	11 767	12 312	12 954
Treasury stock	(53)	(131)	(1 131)	(2 131)	(3 131)	(4 131)	(4 131)
Retained earnings / accumulated deficit	(7 095)	(4 605)	(1 578)	2 287	7 016	12 588	18 697
Other comprehensive income / (loss)	–	17	17	17	17	17	17
Total equity	**2 827**	**5 837**	**8 214**	**11 477**	**15 669**	**20 786**	**27 537**

Appendix C – Cash Flow Statement

CASH FLOW STATEMENT					
Fiscal year	**2021P**	**2022P**	**2023P**	**2024P**	**2025P**
Net income	3 027	3 864	4 729	5 572	6 109
Depreciation and amortization	205	240	282	332	391
Stock based compensation	350	399	462	545	642
Accounts receivable	(1 240)	(556)	(680)	(807)	(959)
Inventory	(699)	(259)	(360)	(483)	(574)
Accounts payable	234	87	120	161	192
Accrued expenses & def revenues	1 078	483	591	702	834
Operating lease right-of-use assets	(13)	(37)	(45)	(54)	(64)
Prepaid expenses and other current assets (not inc. Rec. from related parties)	(195)	(96)	(118)	(140)	(166)
Deferred tax assets (DTAs)	0	0	0	0	0
Other assets	(136)	0	0	0	0
Long-term operating lease liabilities	13	36	44	52	62
Other current liabilities (inc. Payables from related parties)	(8)	0	0	0	0
Other non current liabilities	55	64	19	10	8
Non-cash (PIK) interest	0	0	0	0	0
Cash from operating activities	**2 671**	**4 224**	**5 045**	**5 890**	**6 475**
Capital expenditures	(312)	(365)	(429)	(505)	(596)
Purchases of intangible assets	0	0	0	0	0
Cash from investing activities	**(312)**	**(365)**	**(429)**	**(505)**	**(596)**
Long term debt	86	165	212	259	342
Common dividends	0	0	0	0	0
New share issuances	0	0	0	0	0
Share repurchases	(1 000)	(1 000)	(1 000)	(1 000)	0
Other comprehensive income / (loss)	0	0	0	0	0
Revolver	0	0	0	0	0
Cash from financing activities	**(914)**	**(835)**	**(788)**	**(741)**	**342**
Net change in cash during period	**1 445**	**3 024**	**3 828**	**4 644**	**6 221**

Appendix D – Segment Reporting

SEGMENT REPORTING										
Fiscal year	2020 A	2021P					2022P	2023P	2024P	2025P
Quarter		*Q1A*	*Q2A*	*Q3P*	*Q4P*	*Total*				
Revenues										
Computing and Graphics	6 432	2 100	2 250	2314	2301	8 965	9569	11040	12749	14737
Enterprise, Embedded and Semi-Custom	3 331	1 345	1 600	1786	1925	6 656	8678	10421	12526	15070
Total	9 763	3 445	3 850	4 100	4 226	15 621	18 248	21 461	25 275	29 806
% growth	45,0%	6,2%	11,8 %	6,5%	3,1%	60,0%	16,8%	17,6%	17,8%	17,9%
C&G % of total Sales	65,9%	61,0 %	58,4 %	56,4 %	54,4 %	57,4%	52,4%	51,4%	50,4%	49,4%
EE&SC % of total Sales	34,1%	39,0 %	41,6 %	43,6 %	45,6 %	42,6%	47,6%	48,6%	49,6%	50,6%
% C&G growth	**37%**	7%	7%	3%	-1%	**39%**	10%	10%	10%	10%
% EE&SC growth	**65%**	5%	19%	12%	8%	**100%**	26%	26%	26%	26%

Appendix E – Growth Rates & Margins

GROWTH RATES & MARGINS								
Fiscal year	2018A	2019A	2020A	2021P	2022P	2023P	2024P	2025P
Revenue growth	NA	4,0%	45,0%	60,0%	16,8%	17,6%	17,8%	17,9%
Gross profit as % of sales	37,8%	42,6%	44,5%	48,0%	50,0%	51,0%	51,0%	51,0%
R&D margin	22,1%	23,0%	20,3%	16,3%	16,3%	16,3%	16,3%	16,3%
SG&A margin	8,7%	11,1%	10,2%	8,8%	8,8%	8,8%	8,8%	8,8%
Tax rate	(2,7%)	8,3%	(94,9%)	15,0%	15,0%	15,0%	15,0%	21,0%

Appendix F – Dupont analysis

	2019A	2020A	2021P	2022P	2023P	2024P	2025P
Dupont Analysis							
Gross Margin (%)	42,6%	44,5%	48,0%	50,0%	51,0%	51,0%	51,0%
Operating Margin (%)	9,4%	14,0%	21,0%	23,0%	24,0%	24,0%	24,0%
Interest Burden (%)	59,0%	93,1%	99,3%	99,7%	99,6%	99,6%	99,6%
Tax Burden (%)	203,2%	123,5%	85,0%	85,0%	85,0%	85,0%	79,0%
Net Profit Margin (%)	11,2%	16,1%	17,7%	19,5%	20,3%	20,3%	18,9%
Asset Turnover (x)	1,27x	1,30x	1,41x	1,16x	1,01x	0,91x	0,85x
Return on Assets (%)	14,3%	21,0%	25,0%	22,6%	20,5%	18,5%	16,0%
Financial Leverage (x)	2,59x	1,73x	1,52x	1,47x	1,40x	1,35x	1,32x
Return on Equity (%)	36,9%	36,4%	38,1%	33,2%	28,8%	25,1%	21,2%
Leverage Indicators							
Debt/Equity (x)	1,13x	0,54x	0,52x	0,44x	0,38x	0,34x	0,31x
Net Debt/Equity (x)	(0,38x)	(0,35x)	(0,44x)	(0,58x)	(0,66x)	(0,71x)	(0,74x)
Debt/Capital (x)	0,17x	0,06x	0,04x	0,05x	0,05x	0,05x	0,05x
Operating Efficiency Indicators							
Inventory Turnover (x)	3,9x	3,9x	3,9x	3,9x	3,9x	3,9x	3,9x
Shareholder Indicators							
Diluted Non-GAAP EPS	0,64	1,29	2,24	2,88	3,51	4,12	4,50
Diluted EPS growth (%)	102%	102%	74%	28%	22%	17%	9%

Appendix G – Working Capital Forecasts

WORKING CAPITAL FORECAST							
Fiscal year	**2019A**	**2020A**	**2021P**	**2022P**	**2023P**	**2024P**	**2025P**
Accounts receivable							
Beginning of period			2 066	3 306	3 862	4 542	5 349
Increases / (decreases)			1 240	556	680	807	959
End of period	1 859	2 066	3 306	3 862	4 542	5 349	6 307
AR as % of sales	27,6%	21,2%	21,2%	21,2%	21,2%	21,2%	21,2%
Days sales outstanding (DSO)	101 days	77 days	77 days	77 days	77 days	77 days	77 days
Inventory							
Beginning of period			1 399	2 098	2 357	2 716	3 199
Increases / (decreases)			699	259	360	483	574
End of period	982	1 399	2 098	2 357	2 716	3 199	3 773
Inventory as % of COGS	25,4%	25,8%	25,8%	25,8%	25,8%	25,8%	25,8%
Inventory turnover	3,9x	3,9x	3,9x	3,9x	3,9x	3,9x	3,9x
Accounts payable							
Beginning of period			468	702	788	909	1 070
Increases / (decreases)			234	87	120	161	192
End of period	988	468	702	788	909	1 070	1 262
AP as % of COGS	25,6%	8,6%	8,6%	8,6%	8,6%	8,6%	8,6%
Days payables outstanding (DPO)	93 days	32 days	32 days	32 days	32 days	32 days	32 days
Accrued expenses							
Beginning of period			1 796	2 874	3 357	3 948	4 650
Increases / (decreases)			1 078	483	591	702	834
End of period	1 084	1 796	2 874	3 357	3 948	4 650	5 483
Accrued expenses & def revs as % of sales	16,1%	18,4%	18,4%	18,4%	18,4%	18,4%	18,4%

Appendix H – Property, Plant & Equipment Forecast

PROPERTY, PLANT & EQUIPMENT								
Fiscal year	**2018A**	**2019A**	**2020A**	**2021P**	**2022P**	**2023P**	**2024P**	**2025P**
Beginning of period				641	748	874	1 021	1 195
Plus: Capital expenditures				312	365	429	505	596
Less: Depreciation				(205)	(240)	(282)	(332)	(391)
End of period		500	641	748	874	1 021	1 195	1 400
Capex	163	217	294	312	365	429	505	596
Capital expenditures as % of revenue	2,5%	3,2%	3,0%	2,0%	2,0%	2,0%	2,0%	2,0%
Depreciation	(94)	(142)	(217)	(205)	(240)	(282)	(332)	(391)
Depreciation as a % of capital expenditures	57,7%	65,4%	73,8%	65,6%	65,6%	65,6%	65,6%	65,6%

Appendix I - Other assets/ Liabilities and Deferred Tax assets Forecast

OTHER ASSETS / LIABILITIES & DEFERRED TAXES							
Fiscal year	**2019A**	**2020A**	**2021P**	**2022P**	**2023P**	**2024P**	**2025P**
Prepaid expenses and other current assets (not inc. Receivables from related parties)							
Beginning of period			378	573	669	787	927
Increases / (decreases)			195	96	118	140	166
End of period	233	378	573	669	787	927	1 093
Prepaid expenses and other current assets as % of sales	3,46%	3,87%	3,67%	3,67%	3,67%	3,67%	3,67%
Deferred tax assets (DTAs)							
Beginning of period			1 245	1 245	1 245	1 245	1 245
Increases / (decreases)			0	0	0	0	0
End of period	22	1 245	1 245	1 245	1 245	1 245	1 245
Other assets							
Beginning of period			373	509	509	509	509
Increases / (decreases)			136	0	0	0	0
End of period	357	373	509	509	509	509	509
Other current liabilities (inc. Payables from related parties)							
Beginning of period			153	145	145	145	145
Increases / (decreases)			(8)	0	0	0	0
End of period	287	153	145	145	145	145	145
Other non current liabilities							
Beginning of period			177	232	296	315	325
Increases / (decreases)			55	64	19	10	8
End of period	157	177	232	296	315	325	333

Appendix J – Operating leases Forecast

OPERATING LEASES Fiscal year	2019A	2020A	2021P	2022P	2023P	2024P	2025P
Beginning of period lease asset			208	221	258	304	358
Increases / (decreases)			13	37	45	54	64
End of period lease asset	205	208	221	258	304	358	422
Lease asset as a % of capital expenditures	94%	71%	71%	71%	71%	71%	71%
Beginning of period lease liability			201	214	250	293	346
Increases / (decreases)			13	36	44	52	62
End of period lease liability	199	201	214	250	293	346	408
Lease liability as a % of capital expenditures	92%	68%	68%	68%	68%	68%	68%

Appendix K – Capital Stock Forecast

CAPITAL STOCK *Fiscal year*	2018A	2019A	2020A	2021P	2022P	2023P	2024P	2025P
Common stock / APIC								
Beginning of period				10 556	10 906	11 305	11 767	12 312
Plus: new share issuances				0	0	0	0	0
Plus: Stock based compensation				350	399	462	545	642
End of period		9 975	10 556	10 906	11 305	11 767	12 312	12 954
New share issuance	71	74	85	0	0	0	0	0
Stock based compensation	137	197	274	350	399	462	545	642
SBC as % of all operating expenses	2,3%	3,2%	3,3%	2,9%	2,9%	2,9%	2,9%	2,9%
Treasury stock								
Beginning of period				(131)	(1 131)	(2 131)	(3 131)	(4 131)
Less: Stock repurchases				(1 000)	(1 000)	(1 000)	(1 000)	0
End of period		(53)	(131)	(1 131)	(2 131)	(3 131)	(4 131)	(4 131)
Stock repurchases		(6)	(78)	(1 000)	(1 000)	(1 000)	(1 000)	0

Appendix L – Debt forecast

DEBT *Fiscal year*	**2019A**	**2020A**	**2021P**	**2022P**	**2023P**	**2024P**	**2025P**
Long term debt							
Beginning of period			330	416	581	794	1 053
Additional borrowing / (pay down)			86	165	212	259	342
PIK accrual			0	0	0	0	0
End of period	486	330	416	581	794	1 053	1 395
Interest expense on long term debt			28	37	52	69	92
Weighted average interest rate			7,5%	7,5%	7,5%	7,5%	7,5%
% of interest expense paid in cash			100%	100%	100%	100%	100%
% of interest expense accrues as PIK			0%	0%	0%	0%	0%
AMD's capital structure	15%	5,35%	5,35%	5,35%	5,35%	5,35%	5,35%
Debt amount			416	581	794	1053	1395

Appendix M – Shares Outstanding

SHARES OUTSTANDING *Fiscal year*	2019A	2020A	2021P	2022P	2023P	2024P	2025P
Basic shares outstanding							
Beginning of period			1 211	1 203	1 197	1 192	1 188
+ new shares issued			0	0	0	0	0
- shares repurchased			(8)	(6)	(5)	(4)	0
End of period		1 211	1 203	1 197	1 192	1 188	1 188
Consensus EPS	$0,30	$2,06	$2,49	$3,04	$3,67	$5,27	$5,65
% change in EPS, year-over-year	(3,9%)	577,6%	20,7%	22,1%	20,7%	43,6%	7,2%
Average share price		$105,80	$127,70	$155,91	$188,22	$270,27	$289,76

Appendix N – Unlevered Free Cash Flow to the Firm Calculation

FREE CASH FLOW BUILDUP								
Fiscal year	2018A	2019A	2020A	2021P	2022P	2023P	2024P	2025P
EBITDA	758	1 050	1 955	4 143	5 200	6 324	7 448	8 783
EBIT	451	631	1 369	3 588	4 562	5 580	6 571	7 750
tax rate	*(2,7%)*	*8,3%*	*(94,9%)*	*15,0%*	*15,0%*	*15,0%*	*15,0%*	*21,0%*
EBIAT (NOPAT)	**463**	**578**	**2 668**	**3 050**	**3 878**	**4 743**	**5 586**	**6 122**
Depreciation and amortization				205	240	282	332	391
Stock based compensation				350	399	462	545	642
Accounts receivable				(1 240)	(556)	(680)	(807)	(959)
Inventory				(699)	(259)	(360)	(483)	(574)
Accounts payable				234	87	120	161	192
Accrued expenses & def revenues				1 078	483	591	702	834
Operating lease right-of-use assets				(13)	(37)	(45)	(54)	(64)
Prepaid expenses and other current assets (not inc. Rec. from related parties)				(195)	(96)	(118)	(140)	(166)
Deferred tax assets (DTAs)				0	0	0	0	0
Other assets				(136)	0	0	0	0
Long-term operating lease liabilities				13	36	44	52	62
Other current liabilities (inc. Payables from related parties)				(8)	0	0	0	0
Other non current liabilities				55	64	19	10	8
Unlevered CFO				**2 693**	**4 237**	**5 059**	**5 904**	**6 488**
Less: Capital expenditures				(312)	(365)	(429)	(505)	(596)
Less: Purchases of intangible assets				0	0	0	0	0
Unlevered FCF				**2 381**	**3 873**	**4 629**	**5 398**	**5 892**
% growth					62,6%	19,5%	16,6%	9,2%

Appendix O – Sensitivity Analysis

Equity value per share (table 1)

		Long term growth rate (g):				
	$114,55	3,0%	3,5%	4,0%	4,5%	5,0%
	9,0%	79,34	85,25	92,34	101,02	111,86
	8,5%	86,24	93,43	102,21	113,19	127,30
WACC	8,0%	94,52	103,42	114,54	128,84	147,90
	7,5%	104,65	115,92	130,40	149,71	176,74
	7,0%	117,32	131,99	151,55	178,93	220,00

Equity value per share (table 2)

		Exit EBITDA Multiple				
	$105,00	11,9x	14,4x	16,9x	19,4x	21,9x
	10,0%	74,14	86,01	97,89	109,77	121,64
	9,0%	76,66	89,01	101,36	113,71	126,06
WACC	8,0%	79,31	92,15	105,00	117,84	130,69
	7,0%	82,09	95,45	108,82	122,18	135,55
	6,0%	85,00	98,91	112,82	126,73	140,64

Equity value per share (table 3)

		Exit EBITDA Multiple				
EBITDA % of plan	$105,00	11,9x	14,4x	16,9x	19,4x	21,9x
70%	6 148	60,97	69,96	78,95	87,94	96,93
85%	7 466	70,14	81,05	91,97	102,89	113,81
100%	8 783	79,31	92,15	105,00	117,84	130,68
115%	10 100	88,48	103,25	118,02	132,79	147,56
130%	11 418	97,65	114,35	131,04	147,74	164,44

Appendix P – Peer group summary

Name	Ticker	Products	Manufacturer type	Market cap (size in millions)
AMD	**AMD**		**Fabless**	**113,94**
Intel	INTC	Mentioned in AMD's 10-K	IDM	227,76
Nvidia	NVDA	Mentioned in AMD's 10-K	Fabless	498,46
Broadcom	AVGO	semiconductor and infrastructure software products. Broadcom's product offerings serve the data center, networking, software, broadband, wireless, and storage and industrial markets.	Fabless	195,63
Qualcomm	QCOM	chips for smartphones and wireless communications. QCOM also sells chips into automotive and Internet of Things markets	Fabless	161,23
Texas instruments	TXN	semiconductors and ICs: analog chips and embedded processors	IDM	177,51
Micron technlogy	MU	DRAMs	IDM	95,67

Appendix Q – Multiple Valuation Matrix

	Last Twelve Months (LTM)				Year 1 Forecast - Calendar Year				Year 2 Forecast - Calendar Year				
	EV/ Revenues	EV/ EBITDA	EV/ EBIT	P/E	EV/ Revenues	EV/ EBITDA	EV/ EBIT	P/E	EV/ Revenues	EV/ EBITDA	EV/ EBIT	P/E	PEG ratio
Median	7,3x	17,3x	19,6x	22,7x	8,6x	20,5x	20,3x	20,1x	7,5x	19,1x	18,7x	19,0x	1,1x
High	10,6x	39,1x	44,1x	50,8x	9,9x	30,5x	35,2x	42,8x	9,5x	24,3x	27,7x	33,4x	2,3x
Low	3,0x	5,5x	9,7x	10,6x	4,8x	12,5x	13,8x	14,1x	4,4x	11,6x	12,5x	12,6x	0,6x
Comps-derived AMD value													
Median													
Enterprise value	96 854,2	55 994,5	56 422,0	54 723,2	134 387,5	85 082,3	72 923,5	57 703,2	136 974,3	99 808,8	85 425,1	70 525,9	88 969,0
Net debt	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)
Equity value	100 401,2	59 541,5	59 969,0	58 270,2	137 934,5	88 629,3	76 470,5	61 250,2	140 521,3	103 355,8	88 972,1	74 072,9	92516,0
Shares outstanding	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0
Share price	**$81,56**	**$48,37**	**$48,72**	**$47,34**	**$112,05**	**$72,00**	**$62,12**	**$49,76**	**$114,15**	**$83,96**	**$72,28**	**$60,17**	**$75,16**
High													
Enterprise value	141 766,8	126 692,8	126 692,8	126 692,8	154 858,0	126 692,8	126 692,8	126 692,8	173 688,1	126 692,8	126 692,8	126 692,8	182 436,3
Net debt	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)
Equity value	145 313,8	130 239,8	130 239,8	130 239,8	158 405,0	130 239,8	130 239,8	130 239,8	177 235,1	130 239,8	130 239,8	130 239,8	185983,3
Shares outstanding	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0
Share price	**$118,05**	**$105,80**	**$105,80**	**$105,80**	**$128,68**	**$105,80**	**$105,80**	**$105,80**	**$143,98**	**$105,80**	**$105,80**	**$105,80**	**$151,08**
Low													
Enterprise value	40 248,3	17 953,5	27 741,7	23 644,9	75 596,8	51 788,0	49 818,1	39 429,9	81 396,9	60 688,1	57 204,3	45 766,4	44 025,1
Net debt	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)	(3 547,0)
Equity value	43 795,3	21 500,5	31 288,7	27 191,9	79 143,8	55 335,0	53 365,1	42 976,9	84 943,9	64 235,1	60 751,3	49 313,4	47572,1
Shares outstanding	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0	1 231,0
Share price	**$35,58**	**$17,47**	**$25,42**	**$22,09**	**$64,29**	**$44,95**	**$43,35**	**$34,91**	**$69,00**	**$52,18**	**$49,35**	**$40,06**	**$38,65**

Appendix R – Board of Directors Members and Committees

Director	Board of Directors	Audit and Finance Committee	Nominating and Corporate Governance Committee	Compensation and Leadership Resources Committee	Innovation and Technology Committee
John E. Caldwell	C	•	C		
Nora M. Denzel	•		•	C	•
Mark Durcan	•		•	•	C
Michael P. Gregoire	•	•	•		
Joseph A. Householder**	•	C	•		
John W. Marren	•	•	•		
Lisa T. Su*	•				
Abhi Y. Talwalkar	•		•	•	•

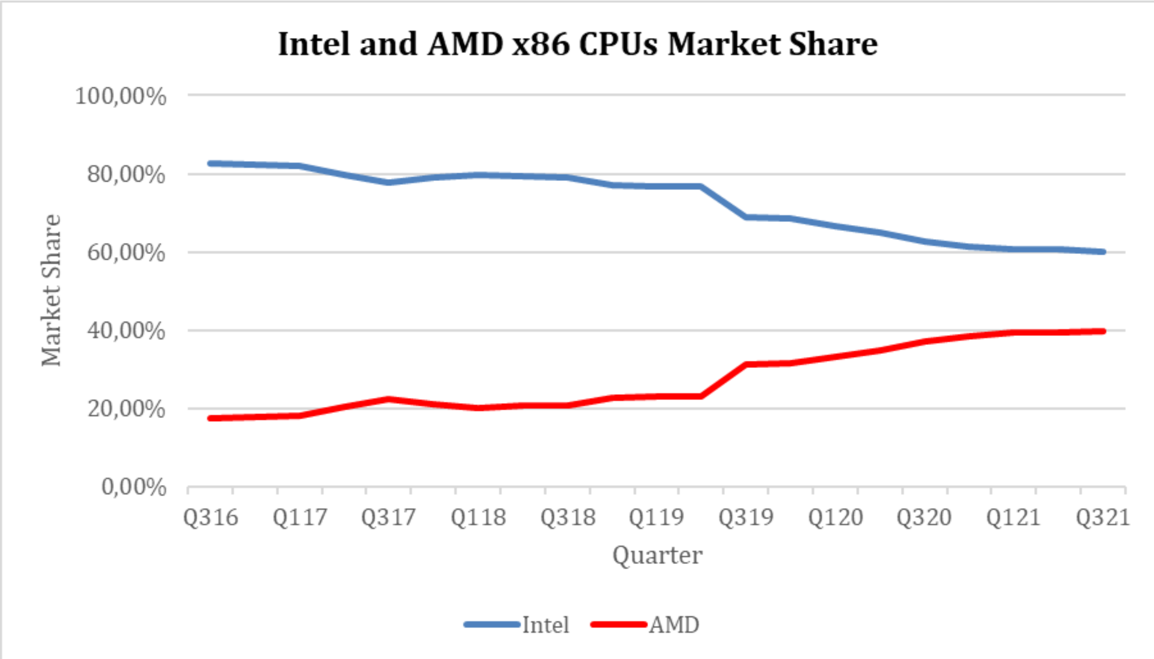
• Member C – Chair * Non independent Director ** Financial Expert

Appendix S – Intel and AMD x86 and laptop CPUs Market Share last 5 years

x86 CPU	Q316	Q416	Q117	Q217	Q317	Q417	Q118	Q218	Q318	Q418	Q119
Intel	82,5%	82,2%	81,9%	79,7%	77,6%	78,9%	79,8%	79,3%	79,1%	77,1%	76,8%
AMD	17,5%	17,8%	18,1%	20,3%	22,4%	21,1%	20,2%	20,7%	20,9%	22,9%	23,2%

(continuation)

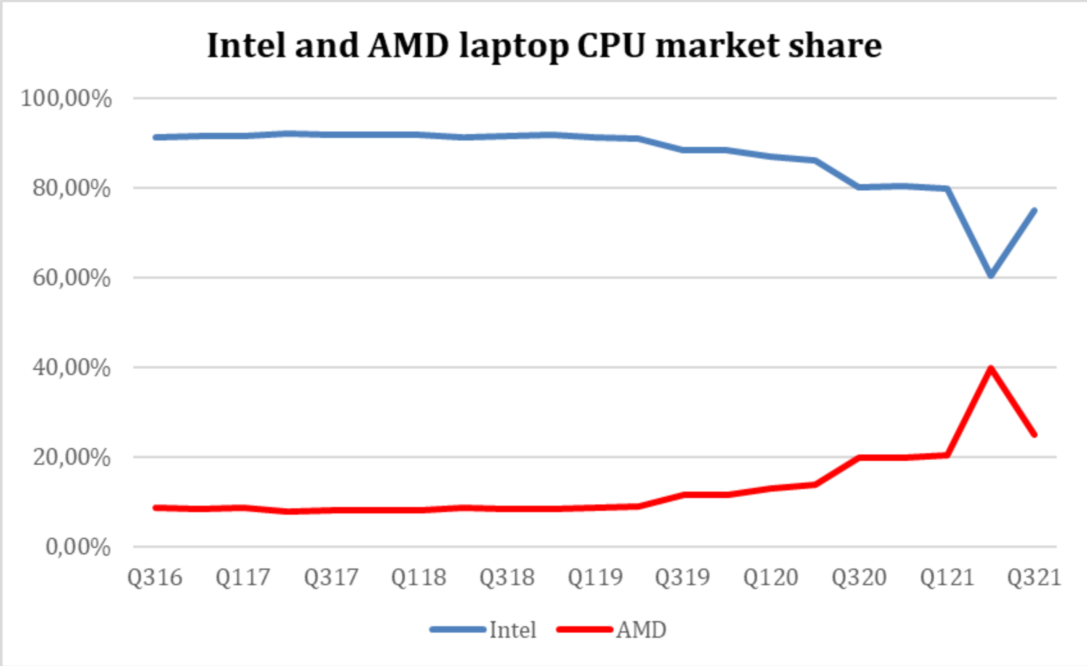
x86 CPU	Q219	Q319	Q419	Q120	Q220	Q320	Q420	Q121	Q221	Q321
Intel	76,9%	68,8%	68,4%	66,7%	65,0%	62,7%	61,5%	60,6%	60,7%	60,2%
AMD	23,1%	31,2%	31,6%	33,3%	35,0%	37,3%	38,5%	39,4%	39,3%	39,8%



Laptop	Q316	Q416	Q117	Q217	Q317	Q417	Q118	Q218	Q318	Q418	Q119
Intel	91,20%	91,50%	91,40%	92,20%	91,80%	91,80%	91,90%	91,30%	91,50%	91,70%	91,30%
AMD	8,80%	8,50%	8,60%	7,80%	8,20%	8,20%	8,10%	8,70%	8,50%	8,30%	8,70%

(continuation)

Laptop	Q219	Q319	Q419	Q120	Q220	Q320	Q420	Q121	Q221	Q321
Intel	91,10%	88,40%	88,40%	86,90%	86,20%	80,10%	80,30%	79,70%	60,30%	75,00%
AMD	8,90%	11,60%	11,60%	13,10%	13,80%	19,90%	19,70%	20,30%	39,70%	25,00%


Intel and AMD laptop CPU market share
100,00%
80,00%
60,00%
40,00%
20,00%
0,00%
Q316
Q117
Q317
Q118
Q318
Q119
Q319
Q120
Q320
Q121
Q321
Intel
AMD

Appendix T - Risk matrix

Impact \ Probability	rare	unlikely	possible	likely	certain
catastrophic	OTR 1	ERR 1	OTR 3		
critical	XMAR 1	LRR 1	ERR 2		
moderate	OTR 2				
minor				GR 1	
neglectable					