

AMD Financial Analysis

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Abstract: In recent years, many popular concepts have been known to the public, such as artificial intelligence, large language models, etc. The development of these industries requires semiconductor equipment to provide computing power as the research basis for theoretical models. Having better computing power equipment will give development companies a greater advantage in the competition in the field of AI. Only a handful of companies on the market can provide computing power for AI research models. The stock prices of AMD companies that produce related equipment have also overgrown this year. Therefore, this paper will focus on the stock price of AMD, one of the computing power manufacturing companies. Through financial data analysis and a stock price model, explore whether this company is currently worth investing in and whether it is overvalued. The hope is to provide readers or investors with some reference materials to judge whether AMD company is worth investing in. The results of this paper show that AMD's overall financial performance is not good, and its stock price is overvalued.

Keywords: AMD, ROE, Valuation.

1. Introduction

In the development of the artificial intelligence industry, a semiconductor device called a graphics processing unit (GPU) is needed to provide computing power because the GPU can achieve a large number of repeated calculations in a short time, which is an essential link in training and accumulating artificial intelligence model data. This is an important reason why the current concept of artificial intelligence has led to semiconductor companies' extremely high market value. However, there may be a massive bubble in current semiconductor companies. Due to the rapid development of the information age, applying these theoretical concepts requires continuous updating of information. Therefore, it is crucial to adjust the valuation model's parameters occasionally. In addition, the current international situation is not very stable. It is essential to rationally analyze the company's value from the perspective of long-term value investment. The central theme of this paper is judging whether a company is worth investing in through stock valuation models and financial information. This paper uses the DuPont analysis method to decompose the Return on equity based on AMD's public annual report and combines the free cash flow model to value the company. Calculating the market value of listed companies is a reference for financial investors.

2. Introduction to AMD

2.1. AMD's information

Advanced Micro Devices, Inc., known as AMD, was founded in 1969. The company focuses on researching and developing semiconductor products. As a global company, AMD sells all over the world. AMD's main products are computer processors (CPUs) and graphics processing units (GPUs). CPUs and GPUs are indispensable semiconductor products for research in artificial intelligence. They are essential components of computers, CPUs, and GPUs of different specifications closely related to computing power. In the discrete graphics card market, Nvidia's market share exceeds 70 percent, while AMD's is less than 30 percent [1]. AMD launches new processors with different architectures every year. According to the previous annual report, from 2019 to 2021, AMD's revenue from these two types of products increased from 4709 to 9332, accounting for 56% of total revenue.

2.2. Overview of past performance of AMD

Although net sales grew significantly from 2019 to 2021, AMD achieved substantial revenue and gross profit growth, reaching a significant peak in 2021. However, due to increased R&D and sales, general and administrative expenses, and other financial pressures, net and operating income in 2022 declined significantly.

From 2021 to mid-2023, as shown in Table 1, AMD's net sales could not be more optimistic, falling from 316.2 billion yuan to 85.4 billion yuan as the international situation undergoes significant changes. From 2019 to 2021, home office and entertainment have led to a surge in demand in the semiconductor industry. While growing steadily from 2019 to 2021, the semiconductor industry's growth rate is also far ahead [2]. During this period, AMD showed an upward trend in its operations. In 2019, net sales were only 6,731 units, but in 2020, they have increased to 9,763 units. The annual net sales growth rates in 2019 and 2020 were as high as 45% and 68%, respectively, which are significant.

However, as the global situation changes, the demand for semiconductor products has gradually declined. At the same time, in 2023, the leading tone of the semiconductor market will be closer to AI computing power. However, this part is precisely the weak part of AMD. There is a clear gap between it and the industry leader Nvidia, and consumers are more inclined to adopt competitors' products. Therefore, sales in 2023 showed a downward trend. Although AMD has shown strong momentum in the past, the situation is not optimistic as it enters a new stage.

Table 1: AMD financial statement

Years	2020	2021	2022	2023
Net revenue	9763	16434	23601	22680
Cost of sales	5416	8505	11550	11278
Amortization of acquisition-related intangibles	0	0	1448	942
Total cost of sales	5416	8505	12998	12220
Gross profit	4347	7929	10603	10460
Research and development	1,983	2845	5,005	5,872
Marketing, general and administrative	995	1448	2,336	2,352
Amortization of acquisition-related intangibles	0	0	2,100	1,869
Licensing gain	0	-12	-102	-34
Operating income	1,369	3648	1,264	401
Interest expense	-47	-34	-88	-106
Other income (expense), net	-47	55	8	197

Table 1: (continued).

Income before income taxes and equity income	1,275	3669	1,184	492
Income tax provision (benefit)	-1,210	513	-122	-346
Equity income in investee	5	6	14	16
Net income	2490	3162	1320	854

As AMD mentioned in its financial statement, the market competition for semiconductor product sales is fierce, and promptly providing the latest and best products to the market is crucial to achieving revenue growth. It is essential for the rapid change of technology, and its competitors will also frequently update technology and launch products. In the subsequent competition, the gap between the products launched by competitors has gradually widened.

The company's net income and gross profit showed strong growth before 2022 and then declined in 2023. This decline may be due to various factors, including market conditions, increased competition, or operational challenges.

2.3. AMD commons size analyze

Table 2: AMD commons size financial statement

Years	2021	2022	2023
Net revenue	100.00%	100.00%	100.00%
Cost of sales	51.75%	48.94%	49.73%
Amortization of acquisition-related intangibles	0.00%	6.14%	4.15%
Total cost of sales	51.75%	55.07%	53.88%
Gross profit	48.25%	44.93%	46.12%
Research and development	17.31%	21.21%	25.89%
Marketing, general and administrative	8.81%	9.90%	10.37%
Amortization of acquisition-related intangibles	0.00%	8.90%	8.24%
Licensing gain	-0.07%	-0.43%	-0.15%
Operating income	22.20%	5.36%	1.77%
Interest expense	-0.21%	-0.37%	-0.47%
Other income (expense), net	0.33%	0.03%	0.87%
Income before income taxes and equity income	22.33%	5.02%	2.17%
Income tax provision (benefit)	3.12%	-0.52%	-1.53%
Equity income in investee	0.04%	0.06%	0.07%
Net income	19.24%	5.59%	3.77%

Table 2 shows that the cost of production and sales of goods by AMD has gradually dropped to 49% in recent years. The reduction in shipping costs played a key role. AMD's annual report mentioned that combining multiple shipping channels led to a cost reduction of approximately 8%. The subsequent release of Ryzen processors and embedded products maintained similar market sales as before, with overseas markets accounting for 66%. Marketing and administrative expenses have increased. Ultimately, the gross profit 2023 dropped from 48.25% in 2021 to 46.12%. It is worth noting that although the total cost has increased, the total cost includes certain expenses that need to be amortized due to the acquisition of some companies in previous years, and these expenses were not in 2021. Therefore, the total cost is maintained within the previous range, reflecting the improvement in the profitability of AMD's products. Another driving factor with apparent changes is the increase in R&D expenses. Compared with 2021, AMD's R&D expenses have increased rapidly

by 8.5%, and the specific amount is twice as much as before. The semiconductor industry has high barriers, including patents and other technologies [3]. AMD can only catch up with its competitors by increasing its R&D spending. The cost increase is due to recruiting more R&D personnel and higher salaries. This trend change shows that AMD's unit profit has increased while focusing on developing the company's future profitability. AMD has spent much money and even consumed huge profits in financing mergers and acquisitions to catch up with its competitors. This has also led to AMD's gross profit remaining flat, but the net profit has dropped significantly.

2.4. Financial Ratio Analysis

Table 3: AMD's ROE

Years	2021	2022	2023
AMD ROE = $\frac{\text{Net income}}{\text{Equity}}$	3162/7497=42.1%	1320/54750=2.41%	854/55892=1.53%

Return On Equity (ROE) ratio is an excellent comprehensive measure of overall performance, indicating how managers use the funds shareholders invest to generate returns. AMD's ROE level has dropped significantly in the past three years. Through the DuPont analysis method, it can be found from Table 3 that the main reason for the decline in AMD's ROE is the decline in profit margins and asset turnover. Although the equity multiplier remains stable, the decline in profitability and asset utilization efficiency harms ROE. This reflects that the company needs to improve market competition, cost control, and investment returns. Therefore, the sharp decline in net profit has caused a massive decline in ROE. However, whether AMD has efficiently used the assets obtained from shareholders to generate profits needs to be further verified through market reactions.

Then, the following will use the DuPont analysis method to explore the changes in AMD's ROE. This method can analyze financial ratios more transparently and provide convenience for report analysts to understand AMD operations and profit status. The advantage of the DuPont analysis method is that it helps managers know the main factor of equity capital return rate, as well as the correlation between net profit margin and total asset turnover rate and the financial ratio [4].

The first-level breakdown of ROE:

$$\text{ROE} = \frac{\text{Net income}}{\text{Total assets}} \times \frac{\text{Total assets}}{\text{Equity}} \quad (1)$$

Table 4: AMD's ROA & EM

Years	2021	2022	2023
ROA = $\frac{\text{Net income}}{\text{Total assets}}$	3162/12419=25.4%	1320/67580=1.95%	854/67885=1.26%
EM = $\frac{\text{Total assets}}{\text{Equity}}$	12419/7497=1.66	67580/54750=1.235	67885/55892=1.214

Return on assets (ROA) represents how much income is generated for every penny of assets invested. EM represents how much assets are generated for every penny of shareholders' equity. Usually, there are two sources of assets for a company. If a company's EM value is significant, its assets are obtained through borrowing. On the contrary, if most of the company's assets come from direct investments by shareholders, then the EM value will be small.

Table 4 shows that from 2021 to 2023, ROA caused a decline in ROE, which means AMD's output of assets invested has declined. From 2021, the decline in AMD's ROA may reflect the decline in profitability during the rapid growth stage. The decline in EM means that AMD's liabilities have

increased. The corresponding decline in ROA, EM, and ROE shows a declining state. In the second level breakdown, $ROA = PM \times ATO$

Table 5: AMD's PM & ATO

Years	2021	2022	2023
AMD PM = $\frac{\text{Net income}}{\text{Sales}}$	3162/16434=19.2%	1320/23601=5.50%	854/22680=3.76%
AMD ATO = $\frac{\text{Sales}}{\text{Total assets}}$	16434/12419=1.32	23601/67580=0.349	22680/67885=0.334

Profit margin (PM) equals net profit divided by sales revenue. This ratio reflects the business ability of the enterprise, and the more profitable the enterprise is, the higher the value will be.

Table 5 shows that AMD's PM in 2021-2023 is the main driving factor for the decline in ROA. It has dropped from 19.2% to 3.76%; as with the results of the previous common size analysis, the decline in PM values reflects AMD's recent disappointing profitability.

Asset turnover (ATO) equals sales revenue divided by average total assets. By observing ATO, entrepreneurs can understand the turnover rate of the company's assets from input to output in daily operations. By comparing the ATO of competitors in the same industry, entrepreneurs can find out the gap between their company and competitors in asset utilization. This will stimulate the motivation for the subsequent management of the company.

As shown in Table 5, although AMD's profitability declined from 2021 to 2023, the ATO value was also abysmal. AMD's asset management has dropped from the original 1.32 to 0.33. The decline in ATO values indicates that AMD's overall total asset turnover rate this year is much slower than last year. AMD's reduced turnover capacity and capital operation efficiency will put more significant pressure on subsequent operations. PM first gradually declined from 2021 to 2023; it can be further decomposed to analyze which link caused the main change, that is, the third level of decomposition of the DuPont analysis method.

$$PM = \frac{\text{Net income}}{\text{Sales}} = \frac{\text{Sales} - \text{COGS} - \text{SGAE} - \text{FX} - \text{Tax}}{\text{Sales}} \quad (2)$$

Formula 2 shows that PM decomposition is consistent with the common size content in the previous section.

Table 6: AMD's PM Key factor

Years	2021	2022	2023
Cost of sales/sales	51.75%	48.94%	49.73%
Amortization of acquisition	0.00%	6.14%	4.15%
Research and development	17.3%	21.21%	53.88%
Marketing, general and administrative	8.81%	9.90%	10.37%
income tax provision	3.12%	-0.52%	-1.53%

The main factors that led to the decline in profitability include the reduction of the amortization ratio of acquisitions in previous years and the growth of R&D and management costs. In terms of income tax provision, it can be seen from the 2023 annual report that income tax benefits of US\$346 million and US\$122 million were recorded in 2023 and 2022, respectively. The change in income tax

benefits was mainly due to the decrease in pre-tax income, US\$185 million of foreign-derived intangible asset income tax benefits, and US\$169 million of research and development tax credits. Thus, part of the income is compensated (see Table 6). If the policy changes, the gross profit may be lower. AMD's subsequent profitability is tested in this case, so the pressure on taxation is still apparent.

$$\frac{1}{ATO} = \frac{\text{total assets}}{\text{sales}} = \frac{\text{Cash}}{\text{sales}} + \frac{\text{AR}}{\text{sales}} + \frac{\text{Inventory}}{\text{sales}} + \dots \quad (3)$$

Table 7: AMD's ATO Key factor

Years	2021	2022	2023
Cash and cash equivalents	15.4%	20.49%	17.34%
Accounts receivable	16.5%	17.48%	23.70%
Inventories	11.9%	15.98%	19.18%
Property and equipment	4.3%	6.41%	7.01%

Among them, the percentage increases in the inverse relationship are more pronounced, including Cash and cash equivalents, Accounts receivable, Inventories, Property, and equipment. Because it is an inverse relationship, these apparent increases will cause ATO to decrease (see Table 7). From this point of view, the operating pressure faced by AMD can be improved by improving the operation efficiency, including the management of cash and cash equivalents, accounts receivable, inventory, property, and equipment.

EM breakdown

$$\frac{\text{Total assets}}{\text{Equity}} = \frac{\text{Liabilities+Equity}}{\text{Equity}} = 1 + \frac{\text{current Liabilities}}{\text{Equity}} + \frac{\text{long-term liabilities}}{\text{Equity}} \quad (4)$$

AMD's EM value is between 1.21 and 1.66, which reflects that AMD previously obtained part of its capital through borrowing. In 2021, it was 1.66. In the following years, EM ratio gradually decreased to 1.24, which means that investors' investment in AMD has increased, and the proportion of debt has decreased.

Table 8: AMD's common size of liability

Years	2021	2022	2023
Current liabilities:			
Accounts Payable, Other	0.00%	0.85%	0.65%
Accounts payable	17.62%	4.55%	3.68%
Accrued liabilities	1.13%	5.62%	5.51%
Current portion of long-term debt, net	32.33%	0.00%	1.34%
Other current liabilities	4.16%	61.00%	78.00%
Total current liabilities	1.31%	11.63%	11.97%

It is evident from Table 8 that the main driving factor for the decrease in EM from 2021 to 2023 is accrued liabilities, which decreased from 32.33% in 2021 to 5.51% in 2023. At the same time, AMD's long-term debt has remained stable, and the ratio record in recent years has not changed much. Therefore, the decline in EM is mainly due to the reduction of debt and the increase in investor capital investment by reducing the cost of financial interest to reduce financial risks. In that case, AMD will significantly improve its ROE value, and the improvement of ROE and other financial data will also increase AMD's stock price. The DuPont analysis model concludes that the recent acquisition and

merger behavior is the critical factor driving AMD's ROE decline. The business strategy has led to an increase in amortization expenses. Although the profitability of products can be maintained at the original level, it ultimately leads to a decline in ROA. On the other hand, AMD's capital management efficiency level has declined from 2021 to 2023, reflected in the decline in ATO, mainly in managing the four capitals of Property and equipment, cash, Accounts receivable, and Inventories. About the EM ratio, AMD reduced its debt ratio in 2021, resulting in a decline in EM. AMD prefers to use its capital for investment to increase its debt level appropriately. There is still much room for improvement in the company's current operations.

3. Market performance

3.1. Evaluation of stock performance

This section aims to measure AMD's performance in the public market by calculating relevant ratios such as Treynor, Jensen's alpha, and T-squared ratios. The market risk-free rate in this section uses the U.S. five-year Treasury bond as a reference. The market's average return will refer to the overall average return of the exchange where AMD is located (Nasdaq et al.). According to data provided by the U.S. Treasury, the average risk-free rate of the U.S. five-year Treasury bond from 2021 to 2023 was 2.72%. The first step is calculating the return on AMD's daily closing price data. AMD's average daily return is 0.11%. Then, calculate the regression equation with the daily return of the Nasdaq index to obtain β value of 1.6594. AMD's average daily return is 0.11%

$$\text{Treynor ratio} = \frac{\bar{r}_p - \bar{r}_f}{\beta} \quad (5)$$

where $\bar{r}_p$ = return of AMD, $\bar{r}_f$ = risk free rate, β from the regression between the portfolio and the benchmark.

The Treynor ratio is mainly used to measure the relationship between each unit of systematic risk and excess return. The Treynor ratio is more suitable when considering adding a new investment to a well-diversified existing portfolio [5]. When a systematic risk occurs, if the excess return obtained by the portfolio is higher, then the market value of the Treynor ratio will be more considerable. Good investors can build a sufficiently diversified portfolio with almost no unsystematic risk and only systematic risk from market fluctuations. Therefore, in the formula of the Treynor Index, the B value represents risk. Combined with the current AMD data, the company's Treynor ratio is calculated to be -0.01558. This value is a terrible performance. Investors cannot obtain excess returns from AMD's stock when facing systematic risks and will suffer excess losses.

$$\begin{aligned} \alpha_p &= [\bar{r}_p - \bar{r}_f] - \beta_p [\bar{r}_M - \bar{r}_f] \\ &= (0.001135 - 0.0272) - 1.659 * (0.000332 - 0.0272) = 0.0185 \end{aligned} \quad (6)$$

To compare the excess returns between the portfolio and the Capital Asset Pricing Model at the same level of systematic risk, Jensen's Alpha can be used. The higher the Alpha, the better the portfolio performance. As calculated above, AMD's Alpha value is 0.0185, which is in a relatively low range. In other words, under the same systematic risk, AMD's profitability is average. Even if AMD's Alpha value is positive, it is less attractive to investors than other better companies.

T^2 is the Treynor square measure, rp^* equal return on the adjusted portfolio.

R_m equal return on the Market average return.

$$T^2 = rp^* - r_m \quad (7)$$

Calculating T^2 , it is necessary to assume that AMD and the market portfolio are at the same level of systematic risk. By adjusting the percentage, AMD stock is combined with the risk-free rate. It is combined into a portfolio with a beta value of 1. The return of the new portfolio is subtracted from the CPMA when the beta value is equal to 1, and the excess return is finally obtained.

$$w_{rp} = 1.0/1.659 = 0.6027 \quad w_{rf} = 1 - 0.6027 = 0.3973$$

$$rp^* = 0.30 \times 2.72\% + 0.70 \times 0.1135\% = 0.008955$$

$$T^2 = 0.008955 - 0.000332 = 0.8623\%$$

Therefore, after combining the market risk-free rate, the portfolio containing AMD's stock outperforms the benchmark by 0.8623%. From the data of these three ratios, It can see that the risk of investing in AMD is still high. First, the Treynor ratio indicates that investing in AMD takes additional risk but does not get excess returns. The other two indicators show that AMD's performance is qualified but needs to be more attractive to investors. Although it is profitable to buy AMD's stock in a good market environment, it is still not recommended to buy it considering its dividend situation and compared with other better stocks.

3.2. Share valuation

There are three mainstream models used for evaluation models, which are usually free cash flow, residual income and discounted dividend models. In this case, AMD's business strategy is to avoid paying dividends. Therefore, residual income and discounted dividends cannot be used. Based on AMD's annual report data, the second noteworthy factor is that the company has a lot of cash on its books. If the residual income model is used, more relevant data is required. Therefore, the residual income model may not be the most appropriate. In the end, only FCFE can be used for analysis. According to the application of the FCFE model, it is assumed that AMD will go through a high-speed growth stage and a stable growth stage next. Considering the factors among industry competitors, it is assumed that AMD will eventually gradually tend to its main competitor, Nvidia. Therefore, the growth rate in the high-speed growth stage is assumed to be 80% of Nvidia. Finally, it enters a stage with a constant growth rate, a permanent growth stage.

3.2.1. Discount rate

The discount rate is designed based on the average stock market return and the risk-free rate. In this case, the risk-free rate refers to the US five-year Treasury yield. Previous data mentioned that the average monthly yield of the US five-year Treasury from 2021 to 2023 was 2.72%. The Nasdaq index yield over the past year was collected, and the market average yield was calculated to be 8.77%. The CAPM model is used to calculate the risk premium. $R = 2.72\% + 1.659 \times (8.77\% - 2.72\%) = 0.127\%$ is calculated using the CAPM model.

3.2.2. Growth rate

According to Nvidia's current financial report, Nvidia's growth rate is 30.78%. As mentioned in the previous chapter, Nvidia occupies most of the market share. Therefore, it is assumed that AMD's sales growth rate will be 80% of Nvidia's growth rate, which is 24%—assuming that in the perpetual growth stage, the growth rate is slightly higher than the inflation rate. The World Bank can obtain the past inflation rate data of the US.

Table 9: US's inflation rate

Country	2020	2021	2022	2023
US	1.23	4.69	8.00	4.1

The average inflation rate is 4.51%. In an ideal situation, assuming that AMD's continued growth rate is higher than the inflation rate, AMD will continue to grow at 7% forever.

According to AMD's annual report, the efficient tax rate is between 10% and 14%, with an average of 12%. NOTE6 shows that the total debt is 1,717 million, and the interest expense is 81.5 million. Therefore, AMD's interest rate is 4.7%. MVCE has been calculated before and is 1,615,786,841*113.91=184.054.279.058.31.

$$WACC = \frac{MVD}{MVD+MVCE} r_d (1 - \text{Tax rate}) + \frac{MVCE}{MVD+MVCE} r_e \quad (8)$$

$$= (1717000000 / 185,771,279,058.31) * 47\% * 88\% + (184,054,279,058.31 / 185,771,279,058.31) * 12.7\% \\ = 12.6\%$$

Table 10: AMD's Present value calculation

Years	2023	2024	2025	2026	2027	2028	2029
Sales	22680	28123.20	34872.77	43242.23	46269.19	49508.03	52973.59
Sales growth rate		24%	24%	24%	0.07	0.07	0.07
Sales growth		5443.20	6749.57	8369.46	3026.96	3238.84	3465.56
NI margin	0.20	0.20	0.20	0.20	0.20	0.20	0.2
NI		5624.64	6974.55	8648.45	9253.84	9901.61	10594.72
(FCInv-Dep)/Sales growth	0.07	0.07	0.07	0.07	0.07	0.07	0.07
FCInv-Dep		381.02	472.47	585.86	211.89	226.72	242.59
WCIInv/Sales growth	0.06	0.06	0.06	0.06	0.06	0.06	0.064
WCIInv		348.36	431.97	535.65	193.73	207.29	221.80
FCFE		5114.07	6431.89	7975.54	9010.47	9641.20	10316.09
growth rate			0.26	0.24	0.13	0.07	0.07
terminal value					192824.07		
discount factor		0.88	0.78	0.69	0.61		
PV(FCFE)		4521.72	5028.21	5512.80	5506.77		
PV(terminal value)					117844.91		
Current value	138414						

AMD's present value (PV) is 1384144100 (see Table 10). The PV is divided by the number of common stocks, 1,615,786,841, so the value per share is \$85.66, far from the stock price of \$113.91 on the 2023 financial report release date. It is an overvalued state. Therefore, the results of this analysis suggest that investors continue to hold or sell the stock and try not to increase investment in the company.

4. Conclusion

This paper analyzes AMD's financial status over the past few years through financial data and estimates the company's present value based on current market conditions. Regarding the current situation, AMD has not performed exceptionally well in the past few years. Although AMD has shown some potential for future development, the company's valuation is still too high overall. Of course, this article may not be detailed enough regarding data estimation and lacks some sensitivity tests. In the future, other valuation models can be used to improve the calculation results.

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