

The Calculation of Market Capitalization of Enterprises Based on Discounted Cash Flow Method An Application on Razer Inc.

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ABSTRACT

The gaming hardware industry is believed to be positively influenced by the pandemic, the demand for valuation of those enterprises has also increased. This paper aims to give an assessment and valuation of Razer Inc. while also studying how the company and the whole gaming hardware industry have performed over years. The market value of Razer Inc. is calculated by the discounted cash flow model. The second section discusses the business trend of the whole gaming hardware industry while the third studies several business indexes and shows how the company has performed during the pandemic period, from 2019 to the end of the first interim of 2021. The last section discusses the DCF model in detail. The capital asset pricing model is also used when estimating the weighted average cost of capital. Based on the model, the estimated market capitalization of Razer by the end of 2020 is \$3.196 billion.

Keywords: Discounted cash flow, Valuation, Razer, Technology

1. INTRODUCTION

1.1. Background

Covid-19 has been a global crisis for three years, it has hugely impacted our jobs, health, and the way we live. Also, it forced a huge number of firms to shut down or completely change their business. News and journals have been discussing this frequently and it is believed that most enterprises and industries over the world have been negatively influenced because of the limitation on social activities or global trades since the global pandemic. However, depending on different industries or sections, the impact is not always necessarily negative. The segregation, or disclosure, forces many people to start working at home, increasing the time they spend in front of their computers and playing video games. As a result, the video game industry benefits from the pandemic and increases its size significantly.

Many investors started to invest in those enterprises in the video game industry, but although in the same industry, different enterprises have different market value and growth trends depending on many things such as business strategies and operating capability. Therefore, to help investors and businessmen make decisions, the demand for the valuation of each of the

enterprises have been increased. Razer Inc. is an American-Singapore multinational technology company that mainly designs and sells gaming hardware while also providing consumer electronics and financial services. It is also known as the 'cult' among gamers because of the RGB light feature on its products. More significantly, Razer has experienced a turn from loss to profit for the first time in 2020. Therefore, the valuation of Razer would be unique from enterprises in the same industry.

When considering approaches for firm valuation, asset-based, relative valuation, and income approach are the three most common ones. The asset-based approach is to get the market value through a reasonable evaluation of the value of the assets and liabilities of the enterprise. In the relative valuation, the value is determined by comparing the targeted company with a reference company, or companies that have traded cases in the market. The assumption is that in a perfect market, similar assets must have similar prices. The income approach is to determine the value of the targeted firm by capitalizing or discounting its expected earnings to a specific date. Methods under the income approach include DCF, IRR, and EVA models. The discounted cash flow (DCF) model has been widely believed as one of the most comprehensive methods for firm evaluation. It considers the overall future profitability of the

enterprise and takes the management level, human resources, and risk level of the enterprise into account.

1.2. Related Research

Kim et al. employed a qualitative method in this study to discuss the existent literature, industry reports, updated information on the topic of destination, e-sport, and economy. Kim selected a few countries with different GDP and government policies. Kim claims that the e-sport industry in a country with higher GDP tends to grow faster, like China. When analyzing the revenue of the industry, he adopted Parshakov and Zavertiaeva's idea that the ability to monetize audience interest is a key component of growth. The impact of Covid-19 also helps boost the e-sport industry to some extent. Kim concludes that esports has the potential to become the next major sport and it will be important for cities and countries to begin investing in the industry [1]. Łukasz et al. adopted automated sentiment analysis to examine the extent and level of pandemic impact on the sport, video game, and tourism industry using the emotional narration of articles related to Covid-19 effects on these industries. The team collects over 100 articles and examined the word used in those articles. The conclusion is that the video game industry is often believed not to be impacted negatively while it profits from stay-at-home and lockdown. In 2020, the sales of videogames increased by 34% as a whole [2].

Admaja and Saputro studied what the opinions and even views of E-Sport are from various points of view. A descriptive quantitative research method was adopted to conclude answers from respondents. The sample contains different types of people. The research studied several games and discusses them separately. The conclusion is that different tournaments of e-sports provide high prizes and salaries for competition, which helps promote the industry a lot. A limitation of this study is that the sample only contains people from India, instead of the whole world, so the result might not be that representative [3]. Baltezaveric et al. presented comprehensive data about the video game industry which includes the size of the global game market, top companies in this industry, and best-positioned video games along with their sales respectively. The idea of a 'two-sided market' is used to predict the growth rate of the video game industry. Finally, the industry brings revenue more than any previous media is the conclusion [4].

Chen studied different private sector roles during the Covid period. Chen claimed that the involvement of private sectors in humanitarian and health crises is not a new phenomenon. After stating cases of Pfizer in 2004 Indian Ocean earthquake and tsunami and global businesses' contribution during the 2014 Ebola outbreak in Western Africa, Chen cited an article from the Verge that Razer Inc. is devoting some of its manufacturing lines to produce surgical masks and will look to donate

up to one million masks to healthcare professionals around the world [5]. Adamczyk and Zbroszczyk comprehensively examined the DCF model and the calculation of the weighted average cost of capital, and also presented both theoretical background and statistics of DCF model usage by financial experts. In the section of the literature review, Adamczyk states three things to mention when determining the formula for calculating the WACC. In the last section, Adamczyk concluded again that the key to DCF model coherency is to apply the appropriate method of capital structure estimation during the calculation of WACC [6].

Lundholm and O'keefe examined why practitioners and researchers get different estimates of equity value when applying the DCF model and RI model. Lundholm first claims that any claim of the RI model's superiority over the CF model is mistaken while even in a practical implementation or large sample study, the models should be equivalent-for every firm every year. Lundholm discussed three common errors when applying the model, which is inconsistent forecasts error, inappropriate discount rate, and missing cash flow error. Then, Lundholm applied an empirical comparison of RI and the DCF model and cited three papers discussing the comparison. Lundholm concludes that if the user starts with forecasted financial statements and an exogenous cost of equity capital, then getting the same value estimate out of each model is only a matter of care [7]. Patena states that the current DCF valuation model has become extremely complex and demonstrates the complexity, while also showing the interrelation within the model and presenting a solution for maintaining the integrity of the model. Then, Patena used several paragraphs to show the interrelation of calculation in the DCF model. Finally, Patena concludes that the model is coherent and all the parts of the process are well integrated. Three parts are indispensable for integrity: the model for creating a forecast should be interactive; the model work via sophisticated mechanisms of loops; and the model should be subjected to sensitivity analysis [8].

Sharma and Prashar provide a comprehensive overview of the relative valuation method. Followed by the general idea of comparable company analysis, Sharma provides a comprehensive list of definitions or terminologies used in the relative valuation method. Benchmarks for comparing companies are provided, along with several terminologies as well. Finally, Sharma states that relative valuation is more likely to reflect market perception and investor sentiment than the DCF model. The disadvantage would be the result may be influenced by undervalued or overvalued stocks in a portfolio [9]. Ayşe and Saritas estimate the firm value of BIST cement industry firms using both the DCF model and the relative valuation method, then examine the accuracy of each method. Genç concludes that the DCF method yields the most realistic results to assist investors

in their investment decisions, but we must be careful in determining the growth rate of WACC [10].

1.3. Objective

The next chapter will first give a brief historical review of the development of video game hardware, then discuss the gaming hardware industry and the video game industry of the United States as a whole. The third chapter discusses Razer's growth trends over these years in detail and focuses on mainly four aspects: profitability, debt-paying ability, operational capability, and development capability. The fourth chapter will focus mainly on the valuation through the DCF method, reasonable predictions like growth rate are based on aspects discussed in previous chapters. The capital asset pricing model (CAPM) is also applied during the calculation of the weighted average cost of capital.

2. THE ANALYSIS ON THE GAMING HARDWARE INDUSTRY

To generate a more accurate valuation of Razer, we should consider the industry Razer belongs to, which is the global gaming hardware industry. Half a century ago, given the rapid development of technology, the carrier of games changed from physical things to a series of electrical signals composed of binary numbers, then video games were born. The keyboard is one of the essential pieces of hardware for gamers. The first direct keyboard input to computers appeared even earlier than the first gaming hardware. In 1956 at MIT, researchers began experimenting using the keyboard as direct input to the operating system. Later, the first gaming hardware PDP-1 (Digital Equipment corporations programmed data processor-1) was produced with the first PC game, The Space War, in 1962. The machine was sold for \$120 thousand, while its main storage medium was paper with holes punched, and the machine itself was not even a computer. Two years later, Douglas Engelbart invented the first mouse in the world. The development is so rudimentary that mice have changed how people interact with computers and operating systems. From then on, in the 1970s and 1980s, the huge development of computer hardware and various forms of video games had emerged. The price of that hardware became cheaper and cheaper. One huge step forward is when Apple announced Apple II in 1977. It was a comprehensive personal computer with most of the features which are also shown on modern computers. Millions of Apple IIs were sold and Apple gave away thousands of Apple IIs to schools, giving a new generation their first access to personal computers. [11] The birth of the Apple II stands for the commercialization of the personal computer. Till then, most of the prototypes of modern computer hardware had been invented, different types of games like AVG (Adventure Games) and ACT (Action Games) were later produced. However, most of the previous games were

based on PC. When SONY launched the PlayStation, a gaming machine with all the advanced ideas, at the end of 1994, it was sold over a million units worldwide in a decade after its release. In 1999, Razer launched the Boomslang, the first-ever competitive gaming mouse. With a comfortable and ergonomic design that could facilitate hours-long gaming sessions, it started a new generation of gaming hardware. After one decade, gaming hardware companies start adding chromatic lights, or RGB, to their product to make them looks more impressive.

Starting from 2010, the gaming hardware market has become more and more competitive, with huge companies like Logitech and Corsair getting in. When considering the market during recent years, one thing that shouldn't be ignored is Covid-19, which hugely impacted the market worldwide. Some articles claim that Covid-19 has brought positive effects on the e-sport, or video game, industry. The U.S. is considered the birthplace of gaming because of the introduction of the first personal computer as mentioned previously. Furthermore, as of 2021, the United States accounted for 28 percent of global gaming market revenues [12]. Therefore, the market data of the United States is crucial for analyzing the global video game industry. It's true that when looking at the data, as shown in Figure 1, the total revenue of the gaming market has increased from \$14.51 billion to \$54.88 billion, from 2017 to 2021, respectively, yielding a CAGR of 39.46%. However, the revenue of gaming hardware almost stays the same, even when the pandemic boosted the whole market. The revenue for 2017 and 2021 are \$4.73 and \$5.4 billion respectively, which yields a CAGR of 3.37%. The gaming hardware market tends to be stable instead of growing as the video game market as a whole does. Gaming peripherals market, as a sub-branch of the gaming hardware market, however, experienced an increase in revenue on a global scale, from \$3.04 billion in 2017 to \$4.64 billion in 2021, and is expected to yield total revenue of \$5.13 billion in 2022. [13] Given that the number of gamers worldwide is expected to reach 1.86 billion, it's reasonable to expect the gaming peripherals market to be growing in the long term as well.

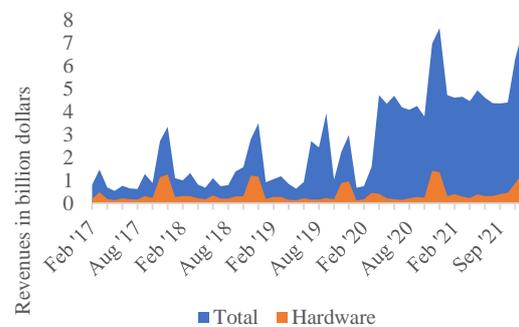


Figure 1 Total and segment revenue of the U.S. video game industry from January 2017 to December 2021 (in billion U.S. dollars)

3. THE ANALYSIS OF RAZER'S OPERATION ABILITY BASED ON FOUR ASPECTS

When analysing the overall performance of Razer, the first point to notice is the company shows a change from loss to profit from 2019 to 2020, and it continues to increase and reach \$31.28 million in the first interim of 2021, which is a 106.61% increase from the end of the year 2020, as shown in Figure 2. Also, the figure shows

a period-on-period increase in the company's revenue. Razer displays a positive growing trend even during the pandemic time in general.

The following will provide an overview of how does Razer performs over these years by considering four aspects. The latest report that Razer published is the Interim Report of 2021. Thus, from Jan. 1st, 2019 to Jun. 30th, 2021 is the selecting period of analysis in the following chapter.

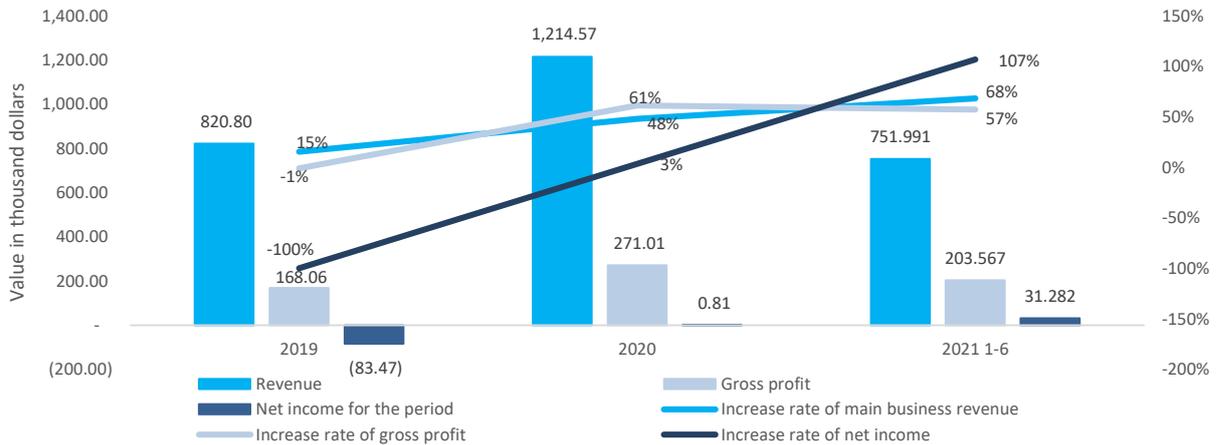


Figure 2 The absolute values (in the histogram) and the increase rate (inline chart) of the revenue, gross profit, and net income (million-dollar) of Razer 2019 to 2021, Jun 30

3.1. Profitability

Based on the annual report, the company has four reportable segments, which are peripherals, systems, software and services, and others. These are the company's business units that offer different products and services and are managed separately because they require different technology and marketing strategies. Since the 'Others' part primarily consists of new products and services including the Razer Phone and THX, while its operating revenue accounted for less than 5% of the total revenue, the following analysis doesn't take this segment into account.

mouse mats developed, marketed, and sold. In terms of revenue, the peripheral segment attained \$444.9 million, and it increased by 73.8% in 2020, reaching \$773.23 million. Under the situation of the global pandemic, the period-on-period increase in revenue of the first interim of 2021 is over 100%, from \$252.71 to \$515.76 million. The gross profit margin remains almost constant from 2019 to 2020, from 26.4% to 26.92%, as the revenue and the gross profit increased simultaneously. However, the gross profit margin increased to 31.41% in the first interim of 2021, as shown in Figure 3. The increase indicates stronger profitability of products in the peripheral segments and stronger profitability of the company in general.

The first segment is the peripherals, it primarily consists of gaming mice, keyboards, audio devices, and



Figure 3 The revenue, gross profit (million dollars), and gross profit margin (%) of the peripheral segment from 2019 to 2021, Jun 30.

The system segment consists of laptops developed, marketed, and sold. The segment's revenue increased from \$269.08 million to \$310.48 million, from 2019 to 2020, while its gross profit dropped from \$32.38 million to \$10.36 million because of the increase in cost. Therefore, the gross profit margin dropped from 12.14%

to 3.34% in that period. The gross profit remained almost the same in the first interim of 2021, at \$10.19 million, while the revenue increased to \$161.54 million. Thus, the gross profit margin went up to 6.31%, as shown in Figure 4. The profitability of the System segment increased slightly.

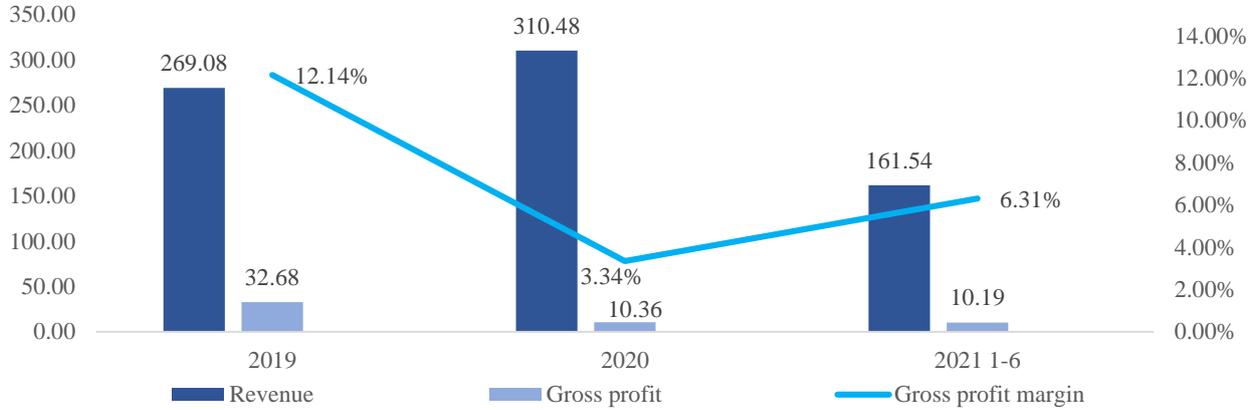


Figure 4 The revenue, gross profit (million-dollar), and gross profit margin (%) of the system segment from 2019 to 2021, Jun 30.

The software and services segment primarily consists of the provision of software over the Razer Software Platform, virtual credits, and payment-related services. As shown in Figure 5, the gross profit margin changed slightly from 42.42% to 41.86%, in 2019 and the first half of 2021, respectively. Therefore, there's no significant

change in the profitability of the software and services segment over the selected period. Also, as the segment's operating revenue accounted for only around 10% of the total revenue of the company, the slight decrease in gross profit margin will not affect the overall profitability of the company.

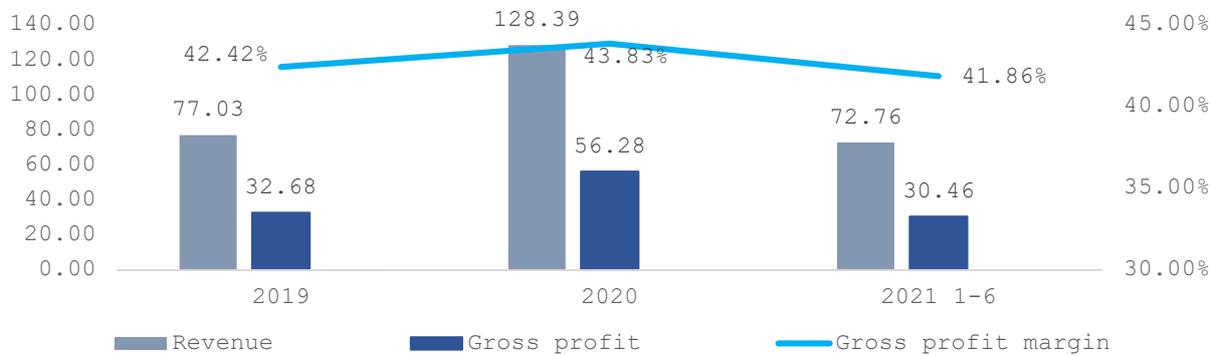


Figure 5 The revenue, gross profit (million-dollar), and gross profit margin (%) of the software and services segment from 2019 to 2021, Jun 30.

In conclusion above, when focusing only on the gross profit margin, the profitability of Razer shows an increasing trend. The same result will be generated when considering the company as a whole as the gross profit margin increased from 20.48% to 27.07% for the selected period. It's also crucial to consider the ROE (Rate of Return on Common Stockholders' Equity). As reported by Razer, its net income was -\$83.47 million and \$805 thousand in 2019 and 2020, respectively, showing a turn from loss to profit and the profit is still growing. As a result, the ROE increased from -13.59% to 5.46% and its profit margin for primary business increased from -

10.17% to 4.16% for the selected period. These also indicate an increasing trend in the profitability of Razer.

3.2. Debt paying ability

When looking at the annual reports of the selected period, as the current liabilities increase from \$401.92 million to \$683.56 million, the total liabilities increased from \$420 million to \$718 million. Note that:

$$\text{Current Ratio} = \frac{\text{Current asset}}{\text{Current Liabilities}} \quad (1)$$

$$\text{Quick Ratio} = \frac{\text{Current asset} - \text{Inventory}}{\text{Current Liabilities}} \quad (2)$$

$$\text{Debt Asset Ratio} = \frac{\text{Total Liabilities}}{\text{Total Assets}} \quad (3)$$

As a result, the debt asset ratio increased. Concurrently, the current ratio and the quick ratio all

dropped, as shown in Figure 6. Therefore, the debt-paying ability is in a decreasing trend.

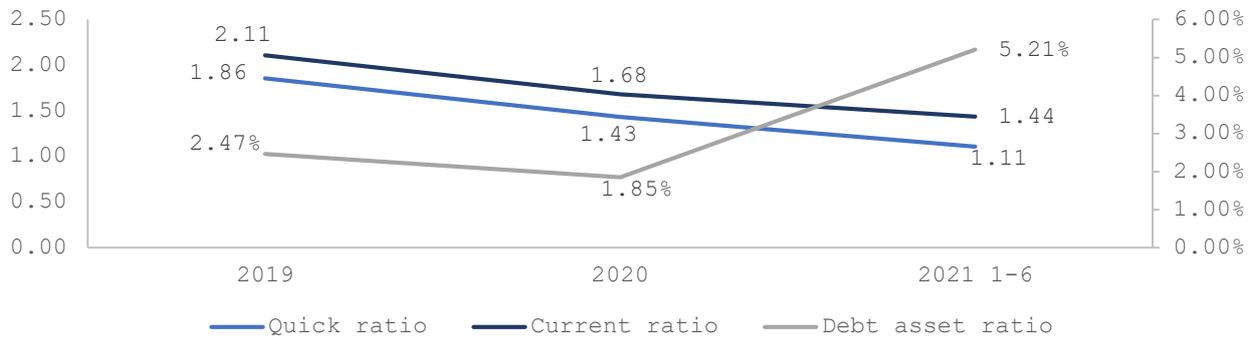


Figure 6 The current ratio, quick ratio, and debt asset ratio of Razer from 2019 to 2021, Jun 30th

3.3. Operational Capability

To analyze operational capability, ROE and ROA are taken into account. Note that:

$$ROE = \frac{\text{Net Income}}{\text{Shareholder's Equity}} \quad (4)$$

$$ROA = \frac{\text{Net Income}}{\text{Total asset}} \quad (5)$$

As shown in Figure 7, looking at the data from the selected period, based on the reported data, both of the two indexes are in an increasing trend. It shows the ability of Razer to utilize its asset to gain profit is strong and still improving. Meanwhile, the inventory turnover and the total asset rate remain stable during the period. These indicators show an increasing trend in the operational capability of Razer.

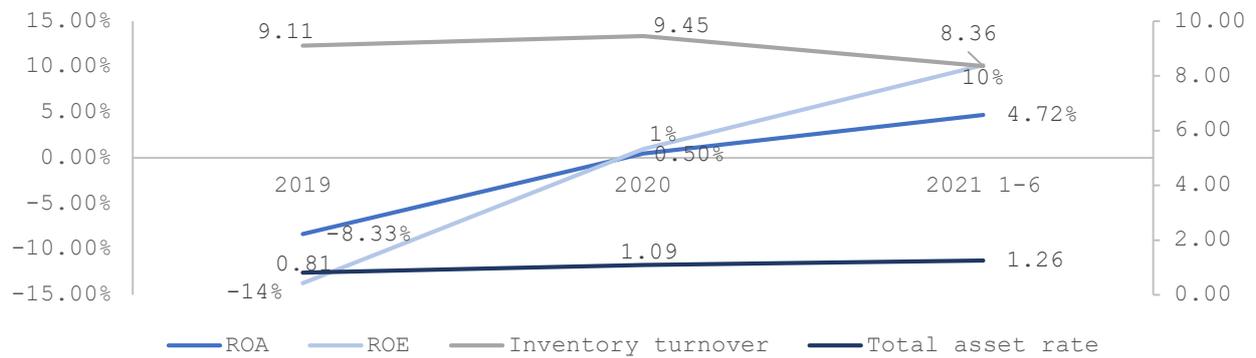


Figure 7 The ROA, ROE, Inventory turnover, and the total asset rate of Razer from 2019 to 2021, Jun 30th.

3.4. Development Capability

When looking at the operating revenue alone, it shows an increasing trend, as stated before, while the growth rate of the revenue is also significant. It displays an increasing trend, from 15.21% to 68.02% during the selected period. It not only stands for the strong development capability but also supports the reasonable prediction that the company's revenue will continue growing in the future. The total asset growth rate from 2019 to 2020 also supports the previous statement, as it increases from -3.39% to 24.94%. There is a slight decrease in the development and research (D&R) input ratio. Since the revenue increased in a large amount, the slight decrease is reasonable. Therefore, based on the operating revenue growth rate, total asset growth rate,

and the D&R input ratio, Razer shows a strong development capability which is also predicted to be increasing in the future.

In conclusion, Although the debt-paying ability performs a slight decrease due to the increase in liabilities, Razer shows strong profitability, operational, and development capability. All of them display an increasing trend which indicates the company is expected to grow in the future.

4. VALUATION

Discount Cash Flow is a method used by finance professionals to estimate the value of a certain investment, or company, based on the expected future cash flow. The main idea is that the current value of a

company is equal to the total amount of all future cash flows discounted at a reasonable discount rate. The model will help both investors and business professionals to make decisions.

4.1. Calculate historical free cash flow (FCF)

The free cash flow is calculated using the formula: Free Cash Flow = Operating Cash Flow – Capital Expenditure. The operating cash flow is denoted as ‘Net cash generated from/ (used in) operating activities’ on Razer’s published reports from 2017 – 2020. Therefore, the analysis will be based on 5 years’ data, and the results of FCF are shown in Table 1.

Table 1. Free cash flow (FCF) of Razer Inc. from 2016 to 2020. (Unit: Million-dollar)

Year	2016	2017	2018	2019	2020
FCF	17.082	31.999	53.631	53.561	134.888

As shown in Table 1, the free cash flow turned positive for the first time. According to the annual report, it is because of the strong increase in operating profits, efficient working capital management, and cash discipline. By the same time, its operating revenue has also crossed \$1 billion for the first time. Because of the positive effect of the COVID-19 pandemic on the video game industry, it’s reasonable to predict that Razer will continue its increase in free cash flow.

4.2. Predicting the free cash flow for the next five years.

It’s hard to predict the increase rate based only on the data of Razer as there exists a turning from negative to positive. Therefore, looking at the whole industry will be helpful. The CAGR of the technology industry in 2025 is expected to be 9%. Considering Razer’s position as a medium in the whole market, the 9% will be used as the average annual increase rate of the free cash flow of Razer. Based on the assumption that the growth rate has a decreasing trend while also considering the equation for calculating the CAGR, assume the growth rate from 2021 to 2023 is *x* and from 2024 to 2025 to be *y*. By finding a solution to the equation

$$((1 + x)^3 (1 + y)^2)^{\frac{1}{5}} = 1.09, x > y \tag{6}$$

One reasonable solution for the inequality would be *x* = 0.13 and *y* = 0.0326. Since over these years, the whole industry is boosting, it’s expected that *x* will be much higher. After a few years, the increase in business will tend to be moderate, and that’s why *y* has a relatively low value. As a result, the predicted free cash flow for 2020 to 2025 is shown in Table 2.

Table 2. Free cash flow (FCF) (predicted) of Razer Inc. from 2021 to 2025. (Unit: Million-dollar)

Year	2021	2022	2023	2024	2025
FCF	152.42	172.24	194.63	200.97	207.53

4.3. Calculate the weighted average cost of capital (WACC).

To calculate WACC, the following equation will be applied:

$$WACC = \frac{E}{(E+D)} * Cost\ of\ Equity + \frac{D}{(E+D)} * Cost\ of\ Debt * (1 - Tax\ Rate) \tag{7}$$

where *E* and *D* stand for shareholder’s equity and the company’s long-term debt, respectively.

Based on the data on the 2020 annual report, the shareholder’s equity is \$581.92 while the long-term debt is \$6.72 million. Therefore, the weight of equity would be 98.86% and the weight of debt is 1.14%.

To calculate the cost of equity, the Capital Asset Pricing Model (CAPM) will be applied. The theoretical model is:

$$R_e = R_f + \beta * (R_m - R_f) \tag{8}$$

where *R_e* is the cost of equity, *R_f* is the risk-free rate of return, *R_m* is the expected return of the market.

To determine the risk-free rate, use the interest rate of US 10-year long-term government bond yields as the risk-free rate. According to the data from FRED, the interest rate in Dec 2020 is 0.93% [14].

Beta is the sensitivity index of expected returns from a certain company to the expected market return. Using the daily stock price of Razer and S&P 500 from Yahoo Finance, by finding daily returns in each of them and finding the linear regression slope of the two return variables, Razer holds a beta of 1.46. Also, *R_e* can be calculated and the result is 8.3%, which is the cost of equity.

To get a simplified cost of debt, just use the equation: Cost of Debt = (Risk-Free Rate Default Spread Country Default Spread) x (1-T), in Razer’s case, the result will be 1.66%. Also, according to Razer’s report, the tax rate equals 21%

Finally, after calculation, WACC = 8.21%.

4.4. Forecasting the enterprise’s value

Note that the discount index equals $\frac{1}{1-WACC}$, then the predicted cash flow after discount could be calculated.

Therefore, the total cash flow of Razer Inc. in the prediction period is \$728.011 million. Then, using the

growth rate of 3.26%, the terminal value for the fifth year is \$2.918 billion. Thus, the Terminal value in 2020 is \$1.967 billion. After adding some of the predicted cash flow after discount, the implied enterprise value is \$2.695 billion. Adding Cash and subtracting debt, the implied equity value (Market Cap) is \$3.196 billion, which is the final result.

5. CONCLUSION

This article applies the discounted cash flow model and provides a reasonable estimation of the market value of Razer on December 31st, 2020 based on the growth trend of the company and the video game industry as a whole. The implied equity value, or the market capitalization, of Razer, is \$3.196 billion, which is \$3 billion higher than the reported value from Finbox [15]. Although the DCF model is most widely used, it still contains many subjective factors such as the growth rate. The market is changing every day and there are numerous factors to consider to predict the growth trend of the company. No matter which method is applied, there will be inevitably some limitations or assumptions that we have to break. Therefore, to attain the most reasonable, or accurate, valuation in practice, investors or businessmen should choose and modify their methods according to the real situation.

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