

Analysis on the Stock Investment Strategy of Apple and Microsoft

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Abstract—The outbreak of Covid-19 has dramatically affected the financial market. Apple and Microsoft, which are at the top of the market value rank, are more concerned by investors. Based on the current situation of stock investment, this paper analyzes the cash flow and macro-economy of Apple and Microsoft, uses the Markowitz mean-variance model to conduct quantitative analysis on the stock portfolio, and determines the optimal investment weight. This paper studies the stock investment value of the two companies, and the results of it are only for investors' references.

Index Terms—Cash flow, Markowitz mean and variance model, PEST model, stock portfolio investment.

I. INTRODUCTION

The outbreak of Covid-19 caused turmoil in many financial markets. With the spread of the virus to the world, the stock market of the US dropped sharply. At the end of February this year, the three major stock indexes of S&P500, DJIA, and NASDAQ fell 11.49%, 12.36%, and 10.54% respectively [1]. Apple inc. closed offline stores in large numbers to prevent the spread of the epidemic and the decline of sales volume. However, Microsoft corporation was not significantly affected by the epidemic, and its revenue and net profit both increased year on year. Stockholders in both companies want higher returns with less risk. In order to help the investors to reduce the investment risk and make the best investment strategy, this essay takes Apple and Microsoft as examples, and uses PEST, MPT model, cash flow statement and other tools to analyze the investment value as well as advantages and disadvantages of the two companies' stocks from the aspects of macro-economy, cash flow status, investment portfolio, expected rate of return and risk, etc., to determine the optimal investment proportion of the two stocks.

II. STOCK INVESTMENT STATUS

A. Stock Investment Status of 2 Companies

Apple is the world's largest company by market capitalization, surpassing a \$1 trillion valuation for the first time in 2018. However, due to the outbreak of Covid-19, in March of this year, the continuous melting of US stocks made the share price of technology stocks sharply decline, which falls up to 12.86%. Apple's market value evaporated by \$161.5 billion overnight [2], and many investors reduced or

cleared their positions in Apple shares.

Microsoft has a market value of \$153 billion, making it the second most valuable company in the world. Microsoft is still in its best shape at the stage of this epidemic. It has become a more digital company due to the popularity of telework during the epidemic and the soaring demand for cloud services [3]. Even when Microsoft closed all its retail stores in June, the stocks remained unaffected.

B. Issuance of the Companies' Shares

On December 12, 1980, Apple's stocks were listed on NASDAQ in the US. Within an hour, 4.6 million shares were sold out, closing at \$29 per share. At that time, it attracted more capital than any IPO after Ford went public in 1956 and quickly entered the world's top 500 within five years [4]. Now Apple share price is \$377 per share.

On March 13, 1986, Microsoft was listed on NASDAQ in the US with the initial offering price of \$21 per share. At that time, Microsoft's net worth was only \$2 million, but today, Microsoft shares are valued at \$203 per share. This made Bill Gates, who was only 30 years old at that time, became a real rich man by the virtue of his stock holdings [5].

C. Macroeconomic Impact on Corporate Stocks Based on PEST Analysis

PEST analysis refers to the analysis of macro-environment. P is for politics, E is for economy, S is for society, and T is for technology. As Table I shows, the external environment of the enterprise group and the situation it faces was analyzed.

TABLE I: PEST OF APPLE AND MICROSOFT (A. STANDS FOR APPLE AND B. STANDS FOR MICROSOFT)

P	E
A. Apple conducts its annual political lobbying.	A. US tax reform policy improves Apple's profits
B. Microsoft hired Haley Barbour to lobby for itself.	B. High labor costs reduce Microsoft's total net profit.
S	T
A. Apple drags down the price of the iPhone to get more consumers during the epidemic.	A. Apple plans to embed two 5G technologies into iPhone 12.
B. Microsoft's performance received support during the epidemic.	B. Microsoft Cloud PC will be launched next year.

1) Politics

A. In recent years, Apple has consistently increased its annual lobbying budget, and it reached to \$662 million in 2017. In June 2017, Apple urged the White House to stay in the Paris Climate Agreement, and take meaningful action on climate change, playing the leading role in US [6].

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B. In the face of an antitrust lawsuit from the government, Microsoft had a significant increase in lobbying spending. In 1999, Microsoft hired Haley Barbour, former chairman of the Republican National Committee, to lobby for itself at the cost of \$620000 a year [7].

Political lobbying keeps the two companies' shares stable.

2) *Economy*

A. In 2017, President Trump proposed tax reform to enhance the competitiveness of American companies in the global market. According to a source, "The plan to cut the statutory corporate tax rate from 35% to 15% would significantly boost Apple's already massive profits. This led to a rise in Apple's share price [6].

B. Microsoft has 131,000 full-time employees, and three-fifths of whom are in North America. However, the increase in labor cost reduced the total net profit of Microsoft company and caused the stock price to decline [8].

3) *Society*

A. This year, in order to reduce the economic losses caused by the epidemic to Apple, the company recently released a \$399 iPhone SE cost-effective phone. Apple Inc. Acquired more consumers through low prices, which made its stock price stable [9].

B. Microsoft's performance was supported by the increased demand for cloud computing and other related businesses due to the Covid-19 outbreak. Microsoft's sales for its fiscal fourth quarter ended in June rose 13% to \$38 billion. This makes Microsoft's share price unaffected [10].

4) *Technology*

A. With the advent of 5G era, in order to improve the signal strength and avoid external interference, Apple intends to embed two kinds of 5G technology into iPhone 12. This will make Apple's stock develop better [11].

B. Foreign media ZDNet reported that in order to provide business customers with the best cloud-based Windows experience, Microsoft is planning to build a Microsoft Cloud PC based on a virtual desktop, which is expected to launch next year. This will make Microsoft's share price higher [12].

III. CASH FLOW ANALYSIS OF STOCK COMPANIES

A. *Analysis on Cash Flow Statement*

The cash flow statement is an essential tool for analyzing stock investments. It records the actual flow of all cash in a company. It's more intuitive than the income statement and the balance sheet, because cash generation is critical to the survival of a company. Even if a company is profitable, as it can't manage its cash flow properly, it will still go bankrupt. The following cash flow statement reflects the impact of operating, investment and financing activities on corporate liquidity in five quarters from March 2019 to March this year for investors' reference. (Note: The following figures are from the Wall Street Journal and Microsoft's official website. [13]-[15])

B. *Cash Flow Analysis on Operating Activities*

Operating activities include selling or buying commodities, operating lease, promoting or marketing products, paying taxes and so on. As shown in Table II, first of all, we see that

the pre-tax incomes of both companies are positive, which indicates that the cash generated from the operating activities is sufficient to cover the daily operating expenses. Secondly, we can see the change in net working capital, which is equal to current assets minus current liabilities. Apple's networking capital was negative in the most recent quarter, suggesting the company may have taken on more debts this year. Finally, the closer a company's revenue is to its net operating cash flow, the better. This reflects the company's ability to turn profits into cash and liquidity.

TABLE II: OPERATING CASH FLOW OF 2 COMPANIES

Apple Inc.	31-Mar-20	31-Dec-19	30-Sep-19	30-Jun-19	31-Mar-19
Operating Cash Flow					
Net Income Before tax	11,249	22,236	13,686	10,044	11,561
Depreciation And Other	2,786	2,816	3,179	2,933	3,040
Funds	16,893	27,839	18,937	15,805	17,130
Changes in Working Capital	(2,002)	4,245	2,160	(2,798)	(4,622)
Deferred Taxes	(302)	(349)	(302)	86	(177)
Net Operating Cash Flow	13,311	30,516	19,910	11,636	11,155
Microsoft Corp.	31-Mar-20	31-Dec-19	30-Sep-19	30-Jun-19	31-Mar-19
Operating Cash Flow					
Net Income Before tax	10,752	11,649	10,678	13,187	8,809
Depreciation And Other	3,118	3,203	2,971	2,924	2,926
Funds	16,444	17,073	16,018	12,124	
Changes in Working Capital	2,450	(5,256)	(927)	4,852	1028
Deferred Taxes	(206)	(53)	(177)	(5,723)	(320)
Net Operating Cash Flow	17,504	10,680	13,818	16,108	42,002

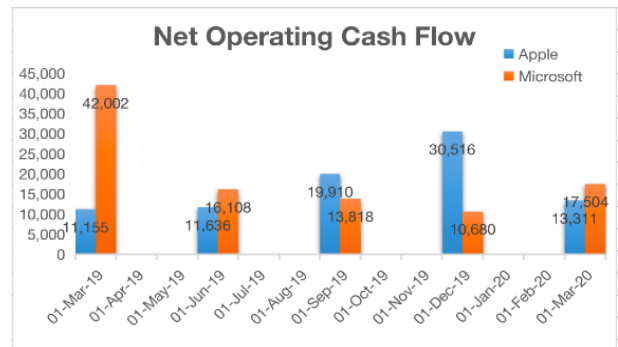


Fig. 1. Comparison on Operating Cash Flow of 2 Companies.

As we can see from the five quarters of Fig. 1, from March 2019 to March this year, the operating cash flow of Apple increased \$2,156 million each quarter, while Microsoft decreased by \$24,498 million. The higher the cash flow of an enterprise's operating capital indicates that the enterprise can turn over its inventory more quickly. This is a clear indication that Apple has better cash flow management from operations.

C. *Analysis on Cash Flow in Investment Activities*

TABLE III: INVESTING CASH FLOW OF 2 COMPANIES

Apple Inc.	31-Mar-20	31-Dec-19	30-Sep-19	30-Jun-19	31-Mar-19
Capital Expenditures	(1,853)	(2,107)	(2,777)	(2,000)	(2,363)
Net Assets from Acquisitions	(176)	(958)	(13)	(320)	(140)
Purchase/Sales of Investments	11,338	(10,473)	2,802	30,120	15,749
Purchase of Investments	(29,142)	(37,493)	(18,097)	(8,190)	(6,840)
Sale/Maturity of Investments	40,480	27,020	20,899	38,310	22,589
Other	(296)	(130)	(810)	(298)	86
Net Investing Cash Flow	9,013	(13,668)	(798)	27,502	13,348
Microsoft Corp.	31-Mar-20	31-Dec-19	30-Sep-19	30-Jun-19	31-Mar-19
Capital Expenditures	(3,767)	(3,545)	(3,385)	(4,051)	(2,565)
Net Assets from Acquisitions	(329)	(80)	(462)	(281)	(269)
Purchase/Sales of Investments	4,147	(2,411)	2,071	(2,925)	1,471
Purchase of Investments	(15,910)	(19,011)	(23,390)	(15,442)	(5,846)
Sale/Maturity of Investments	20,057	16,600	25,461	12,517	7,317
Net Investing Cash Flow	51	(6,036)	(1,776)	(7,257)	(1,363)

Investment activities refer to the purchase and construction of long-term assets and the investment and disposal activities which are not included in the scope of cash equivalents. As Table III shows, when a company expands its scale or develops new projects, it needs to invest a large amount of

cash. Both Apple and Microsoft performed well, with more cash flowing into investment activities than out. That means they can all use their cash flow to pay down debts and generate incomes. In March, Microsoft made up for several quarters of the money it spent on artificial intelligence.

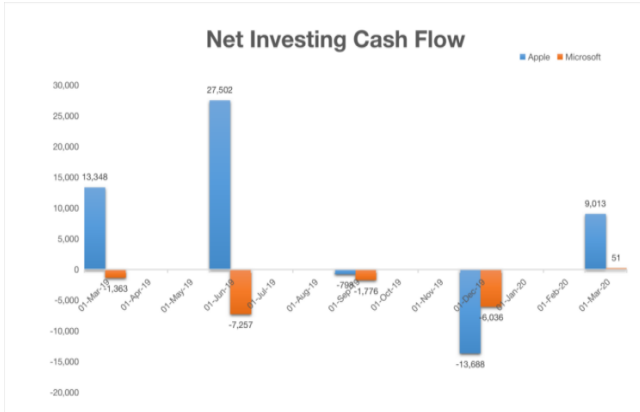


Fig. 2. Comparison on Investing Cash Flow of 2 Companies.

As Fig. 2 shows, from March 2019 to March this year, we can see that Microsoft spent \$1,414 million less while Apple spent \$4,335 million more. This may have something to do with Apple's purchase in January of LG's OLED screen production line for the iPhone, which has even more enormous growth potential in the future.

D. Analysis on Cash Flow in Financing Activities

Financing activities refer to cash inflow and outflow related to capital, including investment absorption, stock issuance, borrowing and trading, profit distribution, etc. As shown in Table IV, the cash flow from net financing activities of the two companies is negative for each of the five quarters. This is not necessarily a bad thing. It means that the company is paying down its debts, the debt ratio of the company will gradually decline, and the proportion of shareholders' equity will increase, which is conducive to the improvement of the stock value.

TABLE IV: FINANCING CASH FLOW OF 2 COMPANIES

Apple Inc.	31-Mar-20	31-Dec-19	30-Sep-19	30-Jun-19	31-Mar-19
Repayment of Debt	803	231	(293)	(5,026)	(2,506)
Common Stock issued	428	2	390	1	390
Common Stock repurchased	(18,574)	(20,706)	(17,444)	(16,955)	(23,702)
Dividend Paid	(3,375)	(3,539)	(3,479)	(3,629)	(3,443)
Other	(222)	(1,395)	(213)	(1,195)	(196)
Net Financing Cash Flow	(20,940)	(25,407)	(21,039)	(26,804)	(29,457)

Microsoft Corp.	31-Mar-20	31-Dec-19	30-Sep-19	30-Jun-19	31-Mar-19
Repayment of Debt	(3,000)	(18)	(2,500)	(1,000)	0
Common Stock issued	342	234	427	308	274
Common Stock repurchased	(7,059)	(5,206)	(4,912)	(4,633)	(4,753)
Dividend Paid	(3,876)	(3,886)	(3,510)	(3,521)	(3,526)
Other	(1,052)	(39)	286	160	404
Net Financing Cash Flow	(14,645)	(8,915)	(10,209)	(8,886)	(7,601)

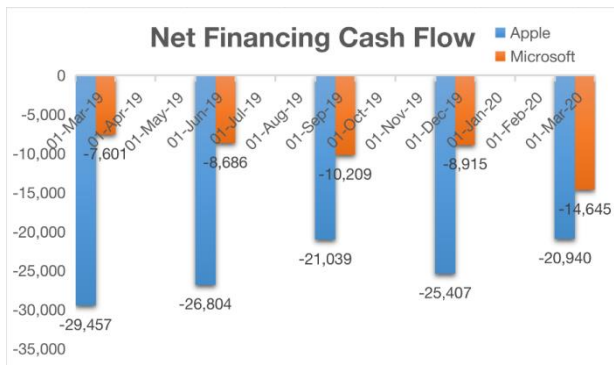


Fig. 3. Comparison on Investing Cash Flow of 2 Companies.

As shown in the Fig. 3, in March 2019 to March 2020, Apple's net financing reduced \$8,517 million, and Microsoft's net financing increased by \$7,044 million. This shows that Apple has a strong debt capacity and solvency. Both companies borrowed money, but it can be seen from Table IV that Apple raised more money by borrowing money than by issuing stock, which may bring long-term interest payment risks.

E. Free Cash Flow Analysis

As we all know, Free Cash Flow = Operating Cash Flow - Capital Expenditures. Free cash flow is the amount of cash a business has at its disposal each year. The cash flow is left after the business pays the necessary operating costs and capital expenditure. The more cash a business has at its disposal, the more money it has to operate or expand. Investors can use it as a tool to evaluate the value of their investments.

As Fig. 4 shows, Apple increased by \$2,666 million from March 2019 to March this year, while Microsoft dropped by \$25,700 million. Both companies have positive free cash flow, indicating that they can generate sufficient profits for other investments. However, Microsoft's sharp decline suggests that the company's financial position may be weak, and investors are advised to Apple's stock because of its more stable free cash flow.

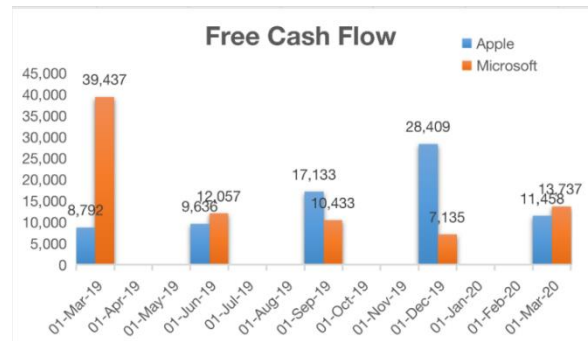


Fig. 4. Comparison on Financing Cash Flow of 2 Companies.

IV. STRATEGIES FOR STOCK INVESTMENT (MPT MODEL APPLICATION)

A. Expected Returns on Portfolio

Let's take two assets A and B as examples to introduce related concepts.

Covariance: The expectation of the product of A and B assets and their expectation E(A), E(B) which measures the changing trends of A and B.

$$COV(A, B) = E[(A - E[A])(B - E[B])] \quad (1)$$

When A=B

$$COV(A, B) = E[(A - E[A])(A - E[A])] = S_A^2$$

Correlation Coefficient: Which reflects the degree of correlation between different asset returns. Value [-1,1]

$$r_{AB} = \frac{COV(A, B)}{S_A S_B} \quad (2)$$

Expected Return: Portfolio returns can be realized in the future. W_A and W_B are the initial investment weights of assets A and B.

$$R_p = W_A R_A + W_B R_B \quad (3)$$

$$W_A + W_B = 1$$

Standard Deviation: Which reflects the sample values of discrete degree, as the measurement of risk indicators.

$$S_p = \sqrt{W_A^2 S_A^2 + W_B^2 S_B^2 + 2r_{AB} W_A W_B S_A S_B} \quad (4)$$

When applied to apple and Microsoft, the covariance of the two companies is known to be 27, σ_A^2 is 53.99, σ_M^2 is 37.40 (The application data is from NASDAQ [16], [17]). We can get

$$r_{AM} = \frac{COV(A,M)}{\sigma_A \sigma_M} = \frac{27}{7.35 \times 6.12} = 0.6 \quad (5)$$

When $r=1$, the rate of return on two assets is positively correlated.

$$\sigma_1 = \sqrt{W_A^2 \sigma_A^2 + W_M^2 \sigma_M^2 + 2W_A W_M \sigma_A \sigma_M} = W_A \sigma_A + W_M \sigma_M \quad (6)$$

Then put r_{AM} into standard deviation formula

$$\sigma_2 = \sqrt{W_A^2 \sigma_A^2 + W_M^2 \sigma_M^2 + 1.2W_A W_M \sigma_A \sigma_M} < \sqrt{W_A^2 \sigma_A^2 + W_M^2 \sigma_M^2 + 2W_A W_M \sigma_A \sigma_M} \quad (7)$$

So $\sigma_2 < \sigma_1$

Therefore, when we add incomplete related assets to the portfolio, we can reduce the risk of the entire portfolio.

B. Modern Portfolio Theory

Modern Portfolio Theory: It is also known as “mean-variance analysis”, and was proposed by Markowitz in 1952. The mean of the securities portfolio represents the expected return, and the variance represents the risk of the portfolio. The core idea is to choose the strategy to maximize the return under the condition of constant risk, or to minimize the risk under the condition of constant expected return [18].

Efficient Frontier: It is sometimes called "a Markowitz bullet" because the shape of it is like the tip of a bullet. The effective frontier has a position with the lowest volatility, that is, the most leftmost part of the curve in the figure, and the position above this point is truly "effective". The finite front is usually the upper half of the curve [18].

TABLE V: PORTFOLIO RISK AND RETURN UNDER DIFFERENT WEIGHTS

W(AAPL)	100%	80%	60%	40%	20%	0%
W(MSFT)	0%	20%	40%	60%	80%	100%
E(Rp)	15.10%	14.50%	13.90%	13.30%	12.70%	12.10%
Standard Deviation	7.35	6.69	6.2	5.92	5.89	6.12

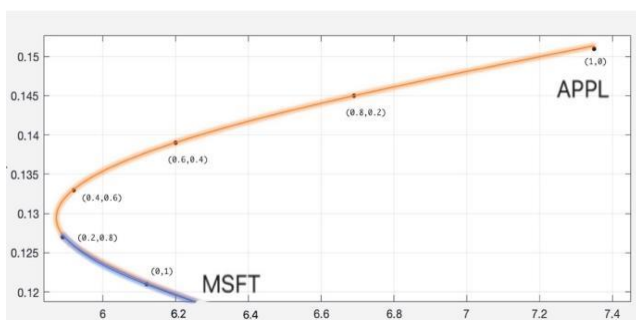


Fig. 5. Feasible set of portfolios with a certain correlation.

For example, from (5) formula, we get $r_{AM}=0.6$, as Table V shows and we can plot the feasible set of portfolios for different weights.

From the Fig. 5, we can see that all the points on the orange line are efficient portfolios, while the blue line is inefficient portfolios. In addition, we usually adopt the $W_{60\%}$ apple + $W_{40\%}$ Microsoft shares investment strategy in order to realize high yield under low risk.

Feasible Set: Under a certain Correlation Coefficient, (3) and (4) equations can be used to determine the expected return rate and standard deviation of the portfolio. Under diverse asset, weights (W_A, W_M) are different. These sets $(\sigma_p, E(R_p))$ constitute the feasible set of the portfolio.

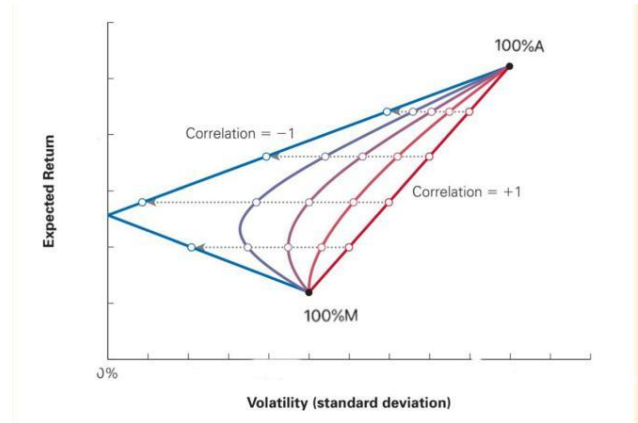


Fig. 6. Feasible set of portfolios with different correlations [19].

When $r_{AM} = 1$, $\sigma_p = W_A \sigma_A + W_M \sigma_M$, $R_p = W_A R_A + W_M R_M$. We can conclude that the points of the portfolio fall on the line AM, and the feasible set is a line.

When $r_{AM} = -1$, Apple and Microsoft stocks are completely negatively correlated. We can get $\sigma_p = |W_A \sigma_A - W_M \sigma_M|$, the feasible set of the asset is two straight lines, and the risk of the asset portfolio is completely eliminated.

When $-1 < r_{AM} < 1$, according to Formula (7), diversification can reduce the total risk of the portfolio. The closer the asset correlation coefficient is to negative 1, the better the diversification effect will be. From Fig. 6, we can also see that when the return of the portfolio is constant, the closer the correlation is to -1, the smaller the standard deviation and the lower the risk.

It can also be seen from the Fig. 6 that, under a certain expected rate of return, the lower the correlation, the lower the risk (standard deviation), so we try to select the stock portfolio with a low correlation when we are investing. The correlation coefficient of Apple and Microsoft stock is 0.6, with a slightly high positive correlation.

V. CONCLUSION

A. Conclusion and Recommendation

This paper analyzes the investment of Apple and Microsoft mainly from the aspects of stock investment status, macro-economy, corporate cash flow, portfolio weight, expected return rate and so on, and determines the best investment strategy. It also provides a meaningful reference

for stock investment.

First of all, by analyzing the current situation of Apple and Microsoft stock investment, we can find that despite the unprecedented impact of the epidemic on the global economy and the fallen shares companies, Microsoft's shift to cloud computing is paying off, so the stock is outperforming Apple's in the short term. But over the long term, Apple has consistently demonstrated its ability to deliver significant returns to shareholders. So Apple still has a lot of potentials. From a macroeconomic point of view, the U.S. tax reform makes it possible for the two companies' stock prices to rise, but with the advent of the 5G era, the companies still need to invest a lot of energy in research and development. Microsoft has a unique core that has a slight advantage over Apple in terms of research and development, and Apple has done a better job than Microsoft in terms of software optimization experience. Secondly, Apple has better cash flow management. Microsoft can improve production efficiency by reducing the number of employees, thus reducing costs and improving operating capital and cash flow. Apple could raise more capital by issuing stock, reducing the risk of long-term interest payments on loans. Finally in the optimal portfolio strategy, we can see through data that the expected rate of return of apple is higher than that of Microsoft, more worthy to investment. However, in order to realize the low risk and high income, using Markowitz efficient frontiers can determine the optimal strategy, that is, investing $W_{60\%}$ apple + $W_{40\%}$ Microsoft shares. From the perspective of correlation coefficient, the positive correlation between the two companies is slightly high, and the advent of 5G era will promote the benign development of the two companies.

B. Deficiencies in Research

Due to the limitations of the author's academic level and the paper length, the research in this paper is still inadequate for investors' reference. For example, this paper fails to make a horizontal and vertical analysis of the cash flow statement and lacks sufficient data to evaluate the company's various financial indicators. Introduction of Beta value analysis system risk in portfolio analysis is required to be done for further studies. The imprecision of the underlying data and the lack of data sensitivity analysis have an impact on the valuation of the company's stock value. It is hoped that these can be adjusted and improved in the future research.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCE

[1] Finance Sina. (2020). Three major US stock indexes fell by more than 10% due to the epidemic. Will the US avert crisis by cutting interest

rates?" [Online]. Available: <http://finance.sina.com.cn/stock/re/news/2020-03-02/doc-iimxxstf5831442.shtml>

[2] Tencent News. (2020). Three circuit breakers in eight days threatens Apple's trillion-dollar plunge in tech stocks. [Online]. Available: <https://new.qq.com/rain/a/20200318A0N13700>

[3] Tencent Finance. (2020). Which of the two crown jewels of US tech stocks, Apple and Microsoft, has the greater upside potential? [Online]. Available: <https://finance.qq.com/a/20200718/005650.htm>

[4] 50 billion of finance. (2020). Apple stock details, how many shares apple issues? [Online]. Available: <https://www.500yi.com/caijingwenda/1019301.html>

[5] Skyangeles. (2011). If you bought 100 shares of Microsoft 25 years ago. [Online]. Available: <http://news.mydrivers.com/1/188/188279.htm>

[6] J. Dudovskiy. (2019). Apple PESTEL analysis. [Online]. Available: <https://research-methodology.net/apple-pestel-analysis-4/>

[7] J. Zheng. (2018). Bill Gates looked at Mark Zuckerberg at the hearing and said: It's all about me, 20 years ago, Microsoft was almost broken up. [Online]. Available: <https://www.ithome.com/html/it/356703.htm>

[8] J. Dudovskiy. (2019). Microsoft PESTEL analysis: Benefiting from social factors. [Online]. Available: <https://research-methodology.net/microsoft-pestel-analysis-2-2/>

[9] S. Oscar. (2020). The changes Apple had to make in the context of the global epidemic. [Online]. Available: <https://baijiahao.baidu.com/s?id=1665866498796309252&wfr=spider&for=pc>

[10] Y. Lei. (2020). A surge in cloud computing demand in the wake of the outbreak has supported the performance of several technology companies. [Online]. Available: <https://baijiahao.baidu.com/s?id=1673066361001522750&wfr=spider&for=pc>

[11] Tencent News. (2020). Apple plans to use two types of 5G technology to be embedded in the latest iPhone. [Online]. Available: <https://xw.qq.com/cmsid/20200702A0VMD300>

[12] Ithome. (2020). Fact: The Microsoft cloud PC will be launched in 2021 and will be based on a virtual desktop. [Online]. Available: https://www.sohu.com/a/408765927_114760?_f=index_pagefocus_6&_trans_=000014_bdss_dkgyxqsP3p:CP=

[13] WSJ.com. (July 31, 2020). WSJ Markets Apple Inc. financials cash flow statement. [Online]. Available: <https://www.wsj.com/market-data/quotes/MSFT/financials/quarter/cash-flow>

[14] WSJ.com. (July 31, 2020). WSJ Markets Microsoft Corp. financials cash flow statement. [Online]. Available: <https://www.wsj.com/market-data/quotes/AAPL/financials/quarter/cash-flow>

[15] Microsoft.com. (July 31, 2020). Investor relations: Earnings release FY20 Q3. [Online]. Available: <https://www.microsoft.com/en-us/Investor/earnings/FY-2020-Q3/cash-flows>

[16] Stock Analysis on Net. (2020). Apple Inc. (NASDAQ: AAPL) Capital Asset Pricing Model (CAPM). [Online]. Available: <https://www.stock-analysis-on.net/NASDAQ/Company/Apple-Inc/D/CF/CAPM>

[17] Stock Analysis on Net. (2020). Microsoft Corp. (NASDAQ: MSFT) Capital Asset Pricing Model (CAPM). [Online]. Available: <https://www.stock-analysis-on.net/NASDAQ/Company/Microsoft-Corp/DCF/CAPM>

[18] Z. Hu. (2016). [Finance] From utility to CAPM series three MPT models. [Online]. Available: https://zhuanlan.zhihu.com/p/22033661?utm_source=wechat_session&utm_medium=social&utm_oi=993923368399204352

[19] J. Berk and P. DeMarzo, *Corporate Finance*, 4th ed. Harlow, United Kingdom: Pearson Education Limited, 2016.

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