

The Impact Of COVID-19 On Electronic Industries Based on Fama-French Five-factor Model

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Abstract. COVID-19 has influenced almost every country in various aspects, especially the worldwide economy. As it is foreseeable that the epidemic will still last in the next few years, it's important to analysis the impact of COVID-19 on the common model used in stock analysis. In this paper, we chose 7 years daily data form four companies of electronic industry (from Jan,1st 2015 to Nov,30 2021) in specific to quantitatively evaluate the effects based on Fama-French five-factor model. Through comparing the Fama-French five-factor coefficients in the first 5 years and the next 2 years, one sees that those economy factors are affected by COVID-19. By processing the 7 years data, the results of two groups are obtained. The test of correlation coefficient, t test, p value test and other tests are applied to exam the result and to see whether the model still suit for present stock market. Subsequently, we focused on the changes in each coefficient, combined with the profit and market, to analyses the performance of different factors. According to the analysis, some of the factors were sharply increased the influence on excess return rate like SMB on HPQ, HML on AAPL, etc. Other factors basically remained the same as before. These results shed light on the reaction on electronic industry in the COVID-19 and pave a path for investors' decisions.

Keywords: Fama-French five-factor model; COVID-19; Electronic industry component; Bigdata analysis.

1. Introduction

The impacts of COVID-19 on the application of Fama-French five-factor model have been made in several industries, such as technology related industries, consumption-related industries and service industry. This model was invented by Eugene F. Fama and Kenneth R. French in 2014, which is a more detailed analysis compare to their Three-factor model. The original three factors are the size of firms, book-to-market values, and excess return on the market. The five-factor model extends the lists by adding two factors: robust-minus-weak profitability (RMW) and low-minus-high (conservative-minus-aggressive) investment (CMA). Its final equation is:

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_iSMB_t + h_iHML_t + r_iRMW_t + c_iCMA_t + e_{it}. \quad (1)$$

Where R_{Ft} is the return in month t of one of the portfolios and R_{Ft} is the risk-free rate [1].

Some tests in several markets (Australia, Eastern Europe and Latin America) have shown that compared with the Fama-French three-factor model, the five-factor model better explains those asset pricing anomalies [2, 3]. Although Dominik Horváth suggested that the five-factor model still works under COVID-19, all the R square value remained on a high enough level to consider them as statistically significant [4], more scholars believe that the model's performance is not sensitive to the way its factors are defined. Taking the result of service industry as an example, COVID-19 has negatively affected the industry as RMW factor increases and becomes significant during the pandemic [5]. Besides, in technological industry, different companies have different situations. After the pandemic, CMA becomes a new significant factor in the hardware industry while RMW and HML experience a remarkable increase in the software and chips industries [6]. In food industry, only the

SMB factor changed significantly in most cases [7]. This paper will mainly focus on electronic industry, which is also one of the most popular markets nowadays and analysis how will the pandemic influence the investment decisions.

The rest part of the paper is organized as follows. The Sec. II will introduce the methods we use in the research, and give the source of data. The Sec. III will give the results of some statistics test. The Sec. IV will analyze the change of every factor, and discuss the limitation and prospect. Eventually, a brief summary will be given in Sec. V.

2. Methodology

2.1 Method

In this paper, we set on Fama-French model and use it to test four electronic companies' data before and during COVID-19. We obtain the industry's data and draw out the whole electronic industry's Fama-French five-factor model. Then we set two kinds of control groups. Firstly, four companies' statistic can be got through regression analysis. Compared those four companies, the data could point out why some of them can keeps a high increasing during the COVID-19, while others are not. Secondly, we build up another control group that includes two period, before the COVID-19 and during the COVID-19. Compared the statistic and coefficient of those companies' five-factor model before and during the COVID-19, and the results could figure out how COVID-19 influence those companies. Besides, we also investigate which factor are enhanced while which performed worse than before to the excess return. In order to analyze the applicability of the Fama-French five-factor models in the electronic information industry before and after the epidemic, the correlation test was first carried out to eliminate multi-collinearity and avoid model distortion due to the correlation between factors. Secondly, this study determines the impact of various factors on the electronic information industry before and after the epidemic through multiple linear regression.

2.2 Data

To more comprehensively measure the applicability of the Fama-French five-factor models in the electronic information industry, four companies, AAPL, MSFT, HPQ, and SONY, were selected as the research objects. Cross-sectional data of these four companies was obtained through finance.yahoo.com, and the relevant data was compared into pre-epidemic and post-epidemic data. In addition, to enhance persuasiveness, this study selected a longer time frame, namely 5 years before the epidemic and 2 years during the epidemic. The daily data are chosen the four companies include the five factors (Mkt-RF, SMB, RMW, HML, RF) in Jan,1st 2015 to Nov,30 2021 containing 1741 sample values. We choose Jan,1st 2015 to Dec, 31st 2019 as the data before the COVID-19, contains 1258 sample values, and choose Jan, 1st 2020 to Nov, 30 2021 to be the compared group which contains 483 sample values. All the data is collected from "yahoo finance".

2.3 Data processing

After the correlation test, the Fama-French five factors of were used as independent variables, and the excess returns of the four companies were used as the dependent variables, and multiple linear regression was analyzed. The specific processing of the data is as follows:

According to the finance.yahoo.com, it is possible to obtain the company's one-day share price, and then calculate the company's one-day return based on:

$$R_{it} = \frac{P_{it}}{P_{it-1}} - 1 \quad (2)$$

Where R_{it} represents the yield of the company i at time t , P_{it} represents the share price of the company i at time t , and then calculates the company's one-day return. Second, the excess return rate of a company is derived by:

$$R_e = R_{it} - R_{ft} \quad (3)$$

Where R_e represents the company's excess return rate, and R_{ft} represents the risk-free rate of return of time t . Afterwards, the company's excess return rate is used as the dependent variable and a multivariate linear regression analysis is performed. The data processing and analysis are all depends on Excel.

3. Empirical analysis

3.1 Correlation test

Table 1. The correlation coefficients on five-factor models (before the COVID-19)

	Mkt-RF	SMB	HML	RMW	CMA
Mkt-RF	1.0000	0.1430	0.0802	0.2192	0.2897
SMB	0.1430	1.0000	0.0617	0.2170	0.0251
HML	0.0802	0.0617	1.0000	0.0253	0.5754
RMW	0.2192	0.2170	0.0253	1.0000	0.0649
CMA	0.2897	0.0251	0.5754	0.0649	1.0000

Multicollinearity refers to the distortion or difficulty in estimating accurate estimates between explanatory variables in a linear regression model due to the presence of an exact correlation or a high correlation relationship. It can be seen from the Tables. I and II that the correlations of the five factors are weak, indicating that there is no multicollinearity of these five factors, and the correlation between the factors does not cause distortion in the model.

Table 2. The correlation coefficients on five-factor models (duringthe COVID-19)

	Mkt-RF	SMB	HML	RMW	CMA
Mkt-RF	1.00000	0.20209	0.19383	0.03254	-0.08537
SMB	0.20209	1.00000	0.51377	-0.13093	0.21177
HML	0.19383	0.51377	1.00000	0.44366	0.55713
RMW	0.03254	-0.13093	0.44366	1.00000	0.39745
CMA	-0.08537	0.21177	0.55713	0.39745	1.00000

3.2 R Square inspection

R Square can be used to measure how well a model fits observations, and in general, the closer the value of R Square is to 1, the better the model fits the observations. By comparing the Tables. III and IV, the Fama-French five-factor model fits these four companies to a higher degree than before the epidemic. In addition, through horizontal comparison, the Fama-French five-factor model fits AAPL and MSFT to a higher degree than HPQ and SONY, both before and after the epidemic.

Table 3. The R square before the COVID-19)

	MSFT	HPQ	SONY	AAPL
Multiple R	0.78190	0.58978	0.51822	0.70157
R Square	0.61137	0.34784	0.26856	0.49220
Adjusted R Square	0.60982	0.34524	0.26564	0.49017
Std.	0.00939	0.01526	0.01666	0.01139

Table 4. The R square during the COVID-19)

	MSFT	HPQ	SONY	AAPL
Multiple R	0.92078	0.73248	0.66604	0.89322
R Square	0.84783	0.53652	0.44361	0.79784
Adjusted R Square	0.84623	0.53167	0.43777	0.79572
Std	0.00862	0.01956	0.01495	0.01085

3.3 p value test

The p value can be used to determine the result of a hypothesis test, and in general, if the p value is small, the probability of the occurrence of the null hypothesis situation is low, which means that the corresponding factor has a higher degree of confidence. The significance level selected in this study is $\alpha=0.05$. For AAPL, the p values of the five factors were small before and after the outbreak, indicating that the confidence level of these five factors was very high. Moreover, Mkt-RF and CMA are more applicable than the other three factors. In the case of MSFT, before the epidemic, the p value of all five factors was lower than 0.05, indicating that the significance level of the five factors was very low. However, in the aftermath of the pandemic, confidence in CMA was greatly reduced, which meant that CMA factors were no longer suitable for interpreting the benefits of MSFT. As for HPQ, only Mkt-RF and HMML had high confidence levels before the pandemic, which could explain the benefits of HPQ. The p values of SMB, RMW, and CMA are high while the confidence levels are too low, thus the applicability of these three factors to HPQ is low. However, after the epidemic, the p value of HML suddenly increased, losing the ability to interpret HPQ benefits. Conversely, the p value of SMB decreases and the confidence level increases, indicating that the applicability of SMB is enhanced. In addition, the confidence level of Mkt-RF after the epidemic remains high. Although the p values of RMW and CMA decreased after the outbreak, they are still above 0.05 and are not suitable for explaining the benefits of HPQ. When it comes to SONY, only the p value of Mkt-RF meets the requirements before and after the outbreak and has a strong confidence level. In the wake of the pandemic, the confidence level of RMW has improved. This means that before the pandemic, only Mkt-RF was available for SONY. After the pandemic, both Mkt-RF and RMW were suitable for SONY, and Mkt-RF was more applicable than RMW. In horizontal comparison, the p values of the five-factor for AAPL and MSFT are lower than those for HPQ and SONY, both before and after the epidemic, which indicates that the confidence level of the five-factor is higher for AAPL and MSFT, and is more suitable for the yield interpretation of AAPL and MSFT. Because for HPQ and SONY, only a few factors have a strong confidence level.

Table 5. Regression results of MSFT, HPQ, SONY and AAPL(before the COVID-19)

	Coefficients	Standard dev.	t Stat	p value	Lower 95%	Upper 95%
MSFT						
Intercept	-0.00345	0.00027	-13.00659	2.27149E-36	-0.00397	-0.00293
Mkt-RF	0.01221	0.00033	36.89532	2.7408E-202	0.01156	0.01286
SMB	-0.00406	0.00054	-7.48588	1.33535E-13	-0.00512	-0.00299
HML	-0.00189	0.00059	-3.21333	0.00135	-0.00305	-0.00074
RMW	0.00217	0.00081	2.67314	0.00761	0.00058	0.00377
CMA	-0.00828	0.00103	-8.05030	1.90514E-15	-0.01029	-0.00626
HPQ						
Intercept	-0.00404	0.00043	-9.37300	3.17983E-20	-0.00489	-0.00320
Mkt-RF	0.01298	0.00054	24.15036	4.2639E-106	0.01193	0.01404
SMB	0.00139	0.00088	1.57416	0.11570	-0.00034	0.00311
HML	0.00194	0.00096	2.03155	0.04241	0.00007	0.00382
RMW	0.00136	0.00132	1.03051	0.30297	-0.00123	0.00395
CMA	0.00171	0.00167	1.02391	0.30607	-0.00157	0.00499
SONY						
Intercept	-0.00331	0.00047	-7.02383	3.53326E-12	-0.00423	-0.00238
Mkt-RF	0.01163	0.00059	19.80811	3.54134E-76	0.01048	0.01278
SMB	0.00073	0.00096	0.75872	0.44816	-0.00116	0.00262
HML	-0.00122	0.00104	-1.16730	0.24331	-0.00327	0.00083
RMW	0.00112	0.00144	0.77937	0.43591	-0.00171	0.00396
CMA	0.00047	0.00182	0.25656	0.79756	-0.00311	0.00405
AAPL						
Intercept	-0.00361	0.00032	-11.22831	6.08835E-28	-0.00425	-0.00298
Mkt-RF	0.01133	0.00040	28.22335	4.9131E-136	0.01054	0.01211
SMB	-0.00152	0.00066	-2.30755	0.02119	-0.00281	-0.00023
HML	-0.00149	0.00071	-2.09407	0.03645	-0.00289	-0.00009
RMW	0.00449	0.00099	4.54967	5.89489E-06	0.00255	0.00642
CMA	-0.01000	0.00125	-8.02266	2.36075E-15	-0.01245	-0.00756

4. Discussion

4.1 Mkt-Rf

Mkt-Rf is the excess return of the market relative to the risk-free investment. The higher Mkt-Rf ratio, the riskier the market is; hence the expected return is higher. From the TABLE VII and Fig. 1, the figures of change in Mkt-Rf of the four companies are all negative, ranging from -18.16% to -91.43%, which means that the Mkt-Rf factor is less influential to the profitability after the pandemic. This is quite easy to understand due to the existence of COVID-19. During the pandemic, the market became quite volatile, which increased the overall level of investment risk. Almost every industry suffered different degree of impacts. Detailed disruptions are like decreased customer demand, major supply chain disruptions, delayed launches of new products and services, and the postpone of capital investment plans etc. About 40% of the companies experienced cash flow problems, the challenge was particularly serious for smaller businesses. On this basis, the excess return would like to be a less crucial factor as all companies in this industry faced a same situation and suffered from a high market risk. It is meaningless at this point to only focus on the excess return relative to the risk-free rate.

Table 6. Regression results of MSFT, HPQ, SONY and AAPL(during the COVID-19)

	Coefficients	Standard dev.	t Stat	p value	Lower 95%	Upper 95%
MSFT						
Intercept	-0.00034	0.00039	-0.86013	0.39015	-0.00112	0.00044
Mkt-RF	0.01214	0.00025	49.11437	1.08E-188	0.01166	0.01263
SMB	-0.00269	0.00053	-5.11357	4.59E-07	-0.00373	-0.00166
HML	-0.00455	0.00044	-10.23537	2.32E-22	-0.00543	-0.00368
RMW	0.00373	0.00078	4.77465	2.40E-06	0.0022	0.00527
CMA	-0.001	0.00098	-1.02378	0.30646	-0.00292	0.00092
HPQ						
Intercept	-0.00029	0.0009	-0.32158	0.74791	-0.00205	0.00147
Mkt-RF	0.01063	0.00056	18.95126	4.04E-60	0.00952	0.01173
SMB	0.00644	0.00119	5.3914	1.10E-07	0.00409	0.00879
HML	0.00127	0.00101	1.25903	0.20863617	-0.00071	0.00325
RMW	0.00333	0.00177	1.87787	0.06101	-0.00015	0.00682
CMA	0.00009	0.00221	0.03897	0.96893	-0.00426	0.00443
SONY						
Intercept	-0.00007	0.00068	-0.10458	0.91675	-0.00142	0.00127
Mkt-RF	0.00817	0.00043	19.05408	1.33E-60	0.00732	0.00901
SMB	-0.00079	0.00091	-0.8624	0.38889	-0.00258	0.00101
HML	-0.00139	0.00077	-1.80671	0.071438	-0.00291	0.00012
RMW	-0.00287	0.00136	-2.11947	0.034567	-0.00554	-0.00021
CMA	0.00285	0.00169	1.68661	0.09233	-0.00047	0.00618
AAPL						
Intercept	-0.00031	0.0005	-0.62321	0.53345	-0.00129	0.00067
Mkt-RF	0.01312	0.00031	42.41215	5.80E-164	0.01258	0.01381
SMB	-0.00202	0.00066	-3.0413	0.00249	-0.00332	-0.00071
HML	-0.00793	0.00056	-14.17185	2.67E-38	-0.00903	-0.00683
RMW	0.00504	0.00098	5.11454	4.56E-07	0.0031	0.00697
CMA	0.01362	0.00123	11.09556	1.32E-25	0.01121	0.01603

4.2 SMB

SMB is the return spread of small minus large stocks, which means excess return depends on the company size. Negative SMB figures indicate that large-scale stocks are more welcomed and tend to have a more significant impact on excess return. In other words, stock markets are more inclined to large enterprises. Large-scale enterprises can benefit not only from economics of scale and scope, but also from their operational experiences. Take Sony as an example, with 26.354 trillion total assets, its SMB figure after the pandemic was -0.0008, meaning the situation was quite beneficial for this company compared to other counterparts. In fact, because the continuing impact of the corona-virus outbreak tends to boost gaming appeal, Sony's PlayStation 5 production almost doubled to 10 million units in 2021 with an increase of 26.3% of the operating profit in the fiscal first quarter at the end of June. Nevertheless, Sony's success doesn't mean that all the medium and small-scale enterprises will definitely suffer. To be clearer about this point, we can focus on the figure of HP. For this company, its SMB figure after COVID-19 was around 0.0064, and the number quadrupled during the pandemic period. Positive SMB indicate a favor for small companies, the reason for this contraction may be explained by the overall demand boost for electronic devices, indicating almost all companies in this industry are likely to gain benefits, despite of the company size. According to IDC, a market research firm, the sales volume of desktops, laptops and workstations reached 72.3 million in the second quarter, up to an 11% increase from a year earlier. Unlike the size of Sony, the total asset of HP was much lower, with around 33 billion in 2017, but this doesn't affect HP's profitability. Its revenue was \$14.3

billion in its fiscal third quarter of 2020, which ended July 31, compared with an average analyst estimate of \$13.3 billion. To conclude, SMB coefficient became more important after the pandemic and nearly all electronic companies find suitable methods to be profitable under the unexpected situation no matter how large they are.

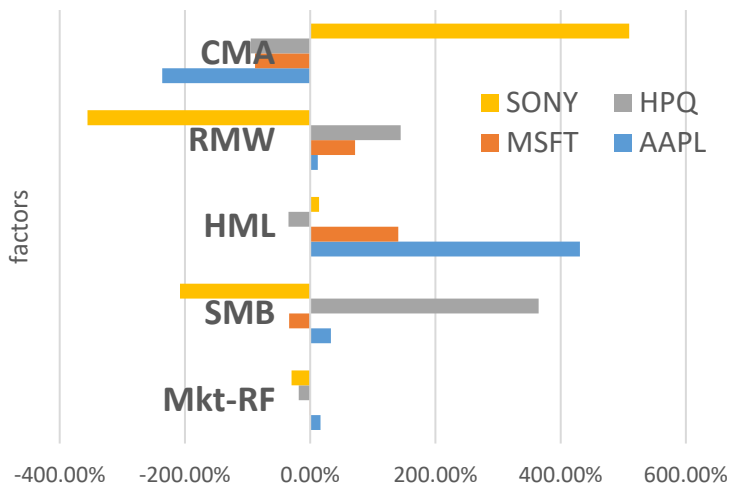


Figure 1. The change of coefficients.

Table 7. The Specific Changes On Every Company

	MSFT	HPQ	SONY	AAPL
Mkt-RF	-0.54%	-18.16%	-29.77%	16.51%
SMB	-33.58%	364.90%	-208.00%	33.00%
HML	140.74%	-34.62%	14.31%	430.80%
RMW	71.79%	144.65%	-355.58%	12.20%
CMA	-87.94%	-94.96%	509.43%	-236.16%

4.3 HML

HML is the value of high B/M ratios minus low B/M ratios, which indicates the relative movement of the stock in response to the Book-to-Market ratio premium. All the companies except HP have negative HML coefficients before and after COVID-19. These low B/M ratio reveals that the market has overestimated these companies, which also means investors are confident in them. This situation might be also explained by the increase in demand as people are likely to pay more attention on the industry and have higher expectations toward it. For HP, although the coefficient was still positive, it experienced a 35% decrease from 0.0019 to 0.0013. This decrease reflects a trend that people are getting more and more confident in this investment. The industry as a whole is not seriously damaged by the pandemic from this perspective and changes in HML factor are the least noteworthy among the five factors. For the entire industry, HML factor indicates the willingness of investors to buy relative stocks and shows a positive but slight trend that the high level of confidence will still continue.

4.4 RMW

RMW is the return spread of the most profitable firms minus the least profitable. It represents the profits level risk, which indicates that industries with higher risks generally may produce higher profitability. Surprisingly, the changes in RMW coefficient were quite significant in all these four companies, especially in Sony and Apple, with -355% and 430% respectively. A negative figure represents that the company can have a high profit with relatively low risk, which is reasonable on Sony as the incredible success on its game section. The PlayStation 5 sold 3.3 million units during Q3, compared to 2.3 million during Q1, with a total sale of 13.4 million units as of September 30, 2021. Meanwhile the hardware sales volume experienced an impressive 287% increase year-on-year, with

\$1.4 billion compared to \$361 million during Q2, 2020 [8]. Such remarkable profit reflects the high value perceived by people, hence despite the market fluctuated a lot during that period, the level of risk bearing by Sony are quite low. The situation for Apple is quite similar. Although its value was four times larger than pre-pandemic period, it was still negative. This is also due to the high popularity among people. Apple created history by becoming the first publicly traded U.S. company to be valued at \$1 trillion, as measured by market capitalization on August 2, 2018. This represented the unshakable position of Apple in the electronic industry. Sony, Apple and Microsoft are all of the most well-known technology brands, indicating that they can minimize their risk by spreading risk on different products or sections. To be more specific, they can take benefit from their size, even if one sector has been negatively affected by COVID-19, the company as a whole will not be significantly influenced. Meanwhile, these companies are usually better managed and have greater access to funding. With these advantages, the large-scale companies are more likely to successfully cope with tough situations similar to the pandemic. They tend to find a realizable solution more quickly than small enterprises, hence face less risk of going bankrupt. HP, unfortunately, has a positive RMW value, and the coefficient in-creased from 0.0014 to 0.0033. It indicates that HP is profitable but with a high level of risk. This is mainly due to the size of company. Hewlett-Packard is a relatively small and new company compared to the other three counterpart, it cannot effectively spread the risk as well as the others and the company have less experience of facing extreme situations like COVID-19. Therefore, even though the industrial situation seems fine, small and medium size companies like HP still need to balance between the profit and risk. If these companies aim to be more profitable, they have to bear much more risk.

4.5 CMA

CMA is the return spread of firms that invest conservatively minus aggressively, it demonstrates the risk of the investment. If the investors are risk-averse, they are tending to look for a higher yield when the risk is higher, which is, in other words, a higher CMA value. As given in TABLE VII, the CMA coefficient for HP is nearly zero, which indicates that the risk of investment in this company is relatively low. This is a little controversial with HP's positive RMW value, but it is understandable as the share price of HP is the lowest among the four. The company choose to offer a safe investment environment at the cost of large profit. The trend for all the other three companies is the same, all of their figures are positive and experienced increases during the pandemic. The highest value after COVID-19 is 0.005 for Apple while Sony has the largest change (510%). This means that these companies were still affected by the pandemic but the overall level was not high. As explained earlier, they are well-organized company with large scale and sophisticated managers, which can help the companies minimize the risks. To conclude, among all the five factors, HML and CMA coefficient bring least influences on the analysis of expected returns while SMB and RMW factor bring the most. Although the entire market risk rises during the pandemic, the investment environment of the electronic industry is still promising as people has a larger requirement of electronics. Almost all size of firms can find their own positions and earn profit in this difficult period.

4.6 Comparsion

We choose to use the Fama-French five-factor model instead of other valuation models, it adds profitability and an investment factor on the original three factors (market risk, size and value). The additional two factors allow investors to analyze the market at more perspectives, which is more likely to result in more comprehensive reports and more accurate investment decisions. Unlike CAPM, which is a single factor model based on relationship between returns and market factor, the Fama-French five-factor model is based on not one but five separate risk fac-tors, hence can explain the expected returns of the portfolios better. However, the five-factor model has drawbacks too. For instance, the addition two factors have drawbacks and this model still ignores momentum and low volatility. According to David, a chief researcher in Robeco, the two new factors are used to explain only their own performance, they make it more difficult to summarize the cross section of stock returns.

Meanwhile, these two factors are still premature since they are relatively recent discoveries and there are not enough researches of these factors in different markets [9]. Moreover, both the Fama-French models do not consider default risk, which means that default risk is not priced in equity returns in these models [10]. Nevertheless, compared to the other two models, the Fama-French three-factor model and CAPM, the performance of Fama-French five-factor model is the best during recent years despite it is still imperfect.

4.7 Limitations & Prospects

Obviously, this research didn't consider about the differences between the four companies while just analyses the five factors in total. In addition, four companies can't represent the whole industry, i.e., our result only suit for the companies themselves. Moreover, we focus a lot on the coefficients change, just give a brief analysis on other statistics. Regarding to the model, the R square in HPQ and SONY is not high enough, and some factors' p value performed badly, either. It means the Fama-French five-factor model cannot fit reality well.

By means that analyses some companies' change between before the and during the global epidemic, we could figure out how it affects economy, and what kind of company could resistant it. For investors, it may give them some tips on how to change their invest strategy on electronic industry when the next global epidemic comes to. Apparently, the COVID-19 will still last for years, further in the study, we could have confident on invest than few years ago. For companies, it could give them some effective points to adjust their internal layout to change Mkt-Rf, SMB, HML, RMW, CMA, to decrease some factors that have a negative impact on excess return, and enhance the others. For researchers, deep in this kind of study can fill up the blank area, and it might give us some reference on any kinds of long-term global disaster, i.e., financial market could improve their environmental risk resistance.

5. Conclusion

This paper adopted Fama-French five-factor model to evaluate the impacts of COVID-19 on returns of electronic companies. We analyzed each of the five factors on Hewlett-Packard, Sony, Apple and Microsoft Corporation. It is clear from the result that among all the factors, HML and CMA coefficient bring least impacts on the analysis of expected returns while SMB and RMW factor bring the most. Meanwhile, COVID-19 has little negative impact on the electronic industry based on the analysis. Although the entire market risk rises during the pandemic, the investment environment of the electronic industry is still promising as people has a larger requirement of electronics. Almost all size of firms can find their own positions and earn profit in this difficult period. Moreover, compared to invest in other industries, it is much safer and profitable for investors to choose companies in the electronic industries. To sum up, these results offer a guideline for companies' strategy and pave a path for the stakeholders that they could predict the expected return more precisely hence make wiser decision makings.

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