Impacts of COVID-19 on U.S. Apparel Industry Based on the Fama-French Five Factor Model

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Abstract. The COVID-19 pandemic has caused a grievous global economic loss and many industries were destroyed by this crisis. Nevertheless, many apparel companies had a remarkable financial performance last year. This research applied the Fama-French Five Factor Model to analyze the influence on the apparel industries under the epidemic. Based on the daily data from Kenneth R. Frencha's database, this paper chose the relevant 18 months data, selecting the outbreak point in February, 2020, as the dividing line. June, 2019 to February, 2020 is the period that before the pandemic, while March, 2020 to November, 2020 is the post-pandemic period. According to the results by multiple regression analysis, it found out that coronavirus pandemic had a radical effect on the apparel industry. Under the influence of COVID-19, investors preferred to put their money in relative aggressive companies to seek new investment opportunities. Therefore, investors need to pay attention to the financial situation and its product, which could be risky for their future development.

Keywords: Fama-French Model; COVID-19; Apparel Industry; U.S. stock market.

1. Introduction

CAPM is a basic theoretical mathematical model in the financial professional field. It was first established in 1964 by American financial management scientist William F. Sharpe to reflect the relationship between systemic risks and securities investment returns [1]. This important formula simply and clearly reveals that the relationship between risk and reward is a linear relationship, and explains the basic principle that the higher the risk, the higher the reward. Since the CAPM model was proposed, it has been widely used especially in the past 20 years. It is mainly manifested in the following aspects. In securities investment, the CAPM model is widely used to determine the necessary rate of return and securities prices for securities investment. In the calculation of the capital cost, the CAPM model is used to calculate the cost of individual capital, especially the cost of common stock. In the determination of the optimal capital structure, the CAPM model is adopted when using the stepwise test method or the weighted average cost of a capital method to determine the optimal capital structure. In fixed asset investment, the CAPM model is often applied to adjust the discount rate when making fixed asset investment decisions under risk conditions. Afterwards, multiple models, including Fama-French three and five factor models, have been proposed and applied in wide fields. In recent years, the asset pricing has been considered a popular topic in the capital market.

The spread of COVID-19 has forced a sharp decline in the global economy, which was a deep and short recession, followed by a slow and uneven recovery. The impact of COVID-19 on the economy can be divided into multiple dimensions: due to the different impacts of the virus and subsequent quarantine measures on various industries, different industries were affected by the epidemic to different degrees. Industries that were highly interactive and relied on face-to-face communication were more affected, and the recovery challenges they face would be more serious than those who

operated well after adopting social distancing measures. The economy of different countries and regions were impacted differently. The differences were caused by different factors, such as the timing and severity of the outbreak, government containment strategies, and monetary or fiscal policy responses.

Over the years, many researchers have studied the Fama-French Five Factor Model in various aspects. Wijaya et al. tested the Fama-French Five Factor Model on stocks listed in the LQ-45 Index over 2013-2015. The research used a multiple linear regression analysis model in the form of panel data for the entire portfolio and each formed portfolio to find experiential evidence on the effect of stock indexes. It found that the market risk premiere had a significant effect on the return; profitability had a positive effect but not significant on return; size and investment had a significant negative effect on return; and the difference in yield lied in the profitability factor, whose effect was not significant on the return [2]. Foye tried to testify whether the new Fama-French Five Factor Model can offer a better description of emerging market equity returns than the three-factor model. After research, it found that the Five Factor Model consistently behaved better than the three-factor model in Eastern Europe and Latin America. However, an investment premium could not be distinguished in the Asian factors and the Five Factor Model was unable to give an improved description of equity returns in the region [3]. Bera and Uyar used the wavelet multi-scale method to study the relationship between the average rate of return and risk factors, and studied the relationship between the rate of return on different time scales. They concluded that the impact of risk factors on average returns varied over time due to the size and statistical significance of their coefficients. The intercept of the scale-based model was close to zero. For long-term investments, there was a period of unexpected cash flow increase in large-value investment portfolios. In different time frames, the active (conservative) portfolio had the lowest (maximum) risk level [4]. Dhaoui and Bensalah used the U.S. stock market (NYSE) data to investigate the asset valuation predictive power of investor sentiment. This research conducted a revised Fama-French Five Factor Model by incorporating two additional variables. Moreover, this research considered three indicators to objectively classify the selected portfolios, namely the value (book-to-market), the profitability, and the investment. Empirical findings confirmed the validity of the standard Fama-French Five Factor Model in predicting the expected returns [5]. Racicot and Rentz tested the effectiveness of Fama-French's new Five Factor pricing model. The purpose of this research was to further investigate this new model by an enhanced GMM-based robust instrumental variables technique. This paper concluded that all factors except the market were not significant at even the 5% level using the GMM approach for most of the sectors in Fama-French Five Factor Model. Thus, adding liquidity in this model did not work well [6].

Moreover, lots of researches have been conducted to study the impact of COVID-19 on the global economy. Nový and Jarý analyzed the impact of COVID-19 on globalization processes affecting the supply and demand sides of individual national economics. After analysis, the research put forward that COVID-19 was a great test for national economies; thus, fiscal and monetary policies must be expansionary in the short term, and government must focus not only on the demand side of the economy, but also on its supply side [7]. Horvath and Wang used the R2 of the model to evaluate the performance of the Fama-French model in the U.S. stock market during the selected events. Through research, they found that the impact of the Dotcom bubble on the R2 of the growth model was statistically significant. However, these results were only for demonstration, and further research was needed to calculate the final impact of the event [8]. Baig and Butt investigated the impact of the COVID-19 pandemic on the microstructure of the U.S. stock market, and explained the dynamics of liquidity and volatility by capturing multiple dimensions of the pandemic. The results indicated that the increase in confirmed cases and deaths caused by the coronavirus was related to a significant increase in market liquidity and volatility. Similarly, the decline in market sentiment and the implementation of restrictions and lock-in measures led to a decline in market liquidity and stability [9]. Michie and Jonathan discussed people's worries about the economy, and stated that the current economic situation should be changed to meet the need of development. The research concluded that the COVID-19 led to international financial crises and recessions, unsustainable inequality in income

and the investor's concern about future pandemics. It also stated that the development of economy has gradually made people focus on the qualitative breaks and systemic change [10].

Because of the epidemic in 2020, the global stock market was seriously impacted. Given this situation, in order to research the impact of COVID-19 on U.S. market, this paper analyzed the impact based on the data from Apparel industry. Through the Fama-French Five Factor Model, this paper compared the results of the five factors Mkt, SMB, HML, RMW and CMA before and during the period of COVID-19. After analyzing the results, it proposed some possible reasons for the obvious influence from COVID-19, and tried to give some suggestions for investor's future investment of U.S. market.

2. Method

The Fama-French Three Factor Model is an asset pricing model which was created by Fama and French in 1992 that expanded on the capital asset pricing model CAPM [11]. It consists of three factors: market risk, the outperformance of small-cap companies relative to large-cap companies, and the outperformance of high book-to-market value companies versus low book-to-market value companies, which extends CAPM with three factors to imitate size and value:

$$Ri=RF + \beta mkt(Rm-Rf) + \beta SMBSMB + \beta HMLHML + \varepsilon i \quad (1)$$

In Eq.(1), Ri is the expected rate of the return on the portfolio, Rf is the risk-free rate, βmkt is factor's coefficient, Rm-Rf is market risk premium, SMB (small minus big) is historic excess returns of small-cap companies over large-cap companies, HML(high minus low) is historic excess returns of value stocks (high book-to-price ratio) over growth stocks (low book-to-price ratio), and εi is the risk.

In 2005, in order to make a better explanation of the expected return of a cross-sectional stock portfolio, Fama and French added two additional factors into the formula: profitability and investment [12], thereby forming the Fama-French Five Factor Model:

$$Ri=RF + \beta mkt\,(RM-RF) + \beta SMBSMB + \beta HMLHML + \beta RMWRMW + \beta CMACMA+\varepsilon i \quad (2)$$

In the upgraded equation, RMW represents the profitable factor which means higher future earnings will have higher returns. It is the return spread of the most profitable firms minus the least profitable ones. CMA represents the investment factor which uses the year-on-year change in total assets. It is the return spread of firms that invest conservatively minus aggressively.

3. Results

This research was conducted based on the data of Apparel industry from Kenneth R. French's database. In order to analyze the effect of COVID-19 of Apparel industry, it selected the daily data of 18 months which started from 3 June, 2019 to 30 November, 2020. The industry data from March 2020 to November 2020 stands for the period of the outbreak; while the data from June 2019 to February 2020 represents the period before the outbreak. According to Fama-French Five Factor Model, this research performed the regression analysis of the selected data, as shown in Table 1 and Table 2. Based on the regression results, it compared the differences of the data from the two periods.

Table 1. Regression results before COVID-19

	Coefficients	**Standard Error**	**t Stat**	**P-value**
Intercept	-0.021	0.051	-0.422	0.674
Mkt-RF	1.025	0.061	16.918	0.000
SMB	0.133	0.114	1.171	0.243
HML	0.054	0.116	0.463	0.644
RMW	0.729	0.192	3.798	0.000
CMA	-0.075	0.235	-0.320	0.749

Table 2. Regression results during the COVID-19

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.017	0.096	0.173	0.863
Mkt-RF	1.020	0.043	23.697	0.000
SMB	0.385	0.114	3.385	0.001
HML	0.362	0.092	3.932	0.000
RMW	0.445	0.196	2.267	0.025
CMA	-0.603	0.247	-2.437	0.016

From Table 1 and Table 2, The Mkt-Rf factor was positive and nearly the same in the two periods. Meanwhile, the SMB factor was not significant before the pandemic but became positive significant after the COVID-19, showing that investors prefer to put their money into small companies after the pandemic. Compared with the results before the COVID-19, the HML became significant after the pandemic. It also became positive relevant after the pandemic, which meant that companies with high book-to-price ratio could generate larger returns during the epidemic. The RMW factor was significant during these two periods, but it slightly decreased after the COVID-19. The CMA factor was not significant before the pandemic, but it became negative significant during the epidemic, which reflected the trend that investors prefer to invest into relatively progressive and radical companies during the epidemic.

4. Discussion

4.1 Mkt

On account of the COVID-19, the global stock markets had slumped in 2020. Many industries were hard hit during the period, such as the tourist industry, catering industry, transportation industry and fashion industry. Compared with the results before COVID-19, the Mkt was nearly consistent during the COVID-19, which showed that the sensitivity of Ri relative to Rm was nearly as the same as the market. The influence of the COVID-19 on the field of Apparel was similar to the effect of the market. There were high correlations between the field of Apparel and the market.

4.2 SMB

SMB was not significant before the COVID-19, but it became significant during the COVID-19. In this period, the SMB indicated that the stock returns of small-cap companies were greater than the stock returns of large-cap companies. Compared to the large-cap companies, small-cap companies were at high risk in the market, and because of the risk premium resulted from COVID-19, there were more purchasers of the stock of small-cap companies. Therefore, the stock returns of small-cap companies were greater. Meanwhile, because of the small scale of small-cap companies, they were more flexible in the unstable market. Thus, it was easier for them to leave the market without an enormous loss, which meant greater stock returns. In addition, nowadays the structure of the small-cap stock was relatively reasonable, and the assessment and elasticity of it were good, which explained the greater returns during the epidemic.

4.3 HML

Based on the data of the t-value the HML factor was not significant before the COVID-19, but it became significant during the epidemic. Meanwhile, the coefficients of HML increased during the COVID-19. Book-to-Market ratio is a mathematical comparison of a company's book value and market value. It can be used to analyze whether a company is overvalued or undervalued. The increase of HML parameter during the epidemic showed that investors tended to choose companies with higher ratios. Before the pandemic, many investors believed the companies with low ratios would grow better so that many of them invested in the lower one. However, this market could be unstable and thus created a bubble market. During the epidemic, the stock prices of these low ratios companies

plummeted, and at the same time the mature and stable companies became mainstream. Thus, the companies with high ratios were favored by the investors again.

4.4 RMW

As for the results of t-value, the RMW factor was significant in the two periods, but the coefficients of it has dropped during the epidemic. Although the profitability coefficient of the industry has declined during the epidemic, the differences between these two periods were relatively slight. The possible reasons for the decline were the quarantine policy and the reduction in economic exchanges. After the epidemic, companies with high yields and stable profits have greatly decreased, which led to the decline of RMW parameter.

4.5 CMA

The CMA factor was not significant before the COVID-19, but it became significant during the COVID-19. Meanwhile, the CMA became negative during the pandemic, which reflected the tendency that investors preferred to put money into relatively aggressive apparel companies. During the pandemic, many conventional companies suffered from severe economic losses, and the bankruptcy of lots of offline stores led them long for new opportunities — the online shopping. As the demand for online shopping increases, many aggressive companies have jumped into the field, which made investors bullish about their future prospects. Moreover, the Apparel industry was overflowing with different brands and styles that catered to various markets around the world. Investors were more willing to put their money into relatively radical and small companies that focused on service quality, pricing, and trendiness, which could gain a competitive advantage in the future [13]. However, it was important for investors to consider the risk of the instability of the financial situation and the market exploration for small companies carefully.

5. Conclusion

In conclusion, this paper adopted the Fama-French Five Factor Model to analyze the impact of COVID-19 of Apparel industry of U.S. stock market. Based on the regression results, it discussed the change of the five factors: Mkt, SMB, HML, RMW and CMA. The Mkt was nearly consistent during the two periods, which showed the high correlations between the field of Apparel and the market. The significant change of SMB meant the stock returns of small-cap companies were higher during COVID-19, as they are more flexible. Meanwhile, because of the uncertainty caused by COVID-19, the significance of HML factor also changed after the pandemic, which indicated mature and stable companies are more likely to be favored during the epidemic. In addition, the change of CMA factor reflected investors tend to invest funds in relatively aggressive companies during the pandemic. Therefore, this paper offered suggestions that investors should choose relatively pragmatic, innovative, and small-scale companies to invest during the epidemic.

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