An empirical study of COVID-19's stock returns to the whole industry in the US stock market

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Abstract: Based on the daily stock data of 49 industry classification data in Kenneth R. French database, this paper adopts the Fama-French five-factor model and adopts multiple linear regression method to empirically study the changes of stock return impact factors of 49 us industries before and after COVID-19. The results show that the marginal effects of market risk factors and investment style factors on stock returns weaken, while the marginal effects of market value factors and value factors increase. The influence of profit factor on stock return is not significant. Post-pandemic, the market favors small-cap stocks, value stocks, and conservative portfolios. Specific to the industry level, the small market value and value stock portfolio of the hotel and catering industry bring greater excess returns; The rare metal industry of high market value, growth stock portfolio excess return is greater; Textile industry value stocks, investment style aggressive portfolio to get better returns. Based on this, when the "black Swan" event comes, we should pay attention to grasp the switch of investment style in order to achieve better returns. At the same time, specific to each industry investment strategy should be different.

Keywords: asset pricing; equity returns; COVID-19

1. Introduction

As a research hotspot of modern finance, many scholars have put forward different asset pricing models with the times since the last century. Sharpe [1] and others proposed a new capital asset pricing model (CAPM) based on portfolio theory and capital market theory. CAPM model believes that the expected return of securities assets is positively correlated with its market beta. The larger the beta, the greater the expected return of assets, and the market beta is enough to explain the expected return of securities assets. After the 1980s, the single factor CAPM model was considered insufficient to explain stock returns. The arbitrage pricing theory (APT) [2] has evolved into a multi factor model based on the CPAM model, which shows that arbitrage behavior is a decisive factor in the formation of efficient market (i.e. equilibrium price). In recent years, with the gradual development and maturity of the capital market, the increasing complexity of socio-economic phenomena and the increase of rational investors in the market, it has become a trend to use a variety of factors to predict the stock value. Dirkx. [3] Based on Fama French five factor model, added factors related to the market, scale, value, profitability, investment and momentum of cdax components, and studied to what extent this six factor model captured the return premium of the German market. The comparison between the six factor model and the three factor model shows that the additional factors increase the explanatory ability of the analysis significantly. Huang [4] compared the performance of traditional asset pricing models such as sharp (1964-1965), Lintner

(1965) capital asset pricing model (CAPM), Fama French (1993), kahart (1997) four factor model and Fama French (2015) five factor model, and found that the performance of the five factor model was better than other models in explaining individual stock returns. Hu [5] found that in the Chinese market, stock returns are closely related to company size, and SMB factor is the most important factor to capture returns in the Chinese stock market. Gaunt [6] found that the three factor model has significantly improved the interpretation ability of CAPM by prolonging the observation time, which proves that BM factor plays an important role in asset pricing. The research results of petkova [7] show that HML and SMB are significantly correlated with the state variables predicting excess market return and its variance.

At present, few literatures have used the capital asset pricing model to analyze the factors affecting the stock returns of COVID-19's US stocks after the whole industry, and draw the recommendations of US stock investment accordingly.

2. Research design

2.1 Variable selection and measurement

2.1.1   Explained variable.

This $R_i - R_f$ paper takes (excess return of portfolio) as the explanatory variable, where RI is the fund return and Rf is the risk-free return. The explained variable is used to measure the excess or decrease of the stock return of the industry relative to the fund return.

2.1.2   Core explanatory variables.

$R_M - R_f$ Market risk premium factor; SMB (small minus big) is the scale factor, which shows the difference between the yield of small market value portfolio and large market value portfolio; HML (high minus low) is the value factor, that is, the difference between the yield of high book to market ratio portfolio and low book to market ratio portfolio; RMW (robust minus weak) is the profit factor, which is the difference between the monthly yield of the portfolio with good profitability and the portfolio with poor profitability; CMA (conservative minus aggressive) is an investment style factor, which is the difference between the yield of conservative company portfolio and aggressive company portfolio.

The standard for grouping the stocks in the market is: according to the market value of listed companies, they are divided into small market value large-scale stocks and large market value large-scale stocks, accounting for 50% each; Then, according to the book to market value ratio of listed companies at the end of the year, it is divided into three categories: H (high book to market value ratio), m (medium book to market value ratio) and l (low book to market value ratio), each of which is 33%. They are combined to form six groups: SL, SM, SH, BL, BM and BH.

$$SMB = \frac{SL+SM+SH}{3} - \frac{BL+BM+BH}{3} \tag{1}$$

$$HML = \frac{BH+SH}{2} - \frac{BL+SL}{2} \tag{2}$$

Based on this, Fama and French proposed a five factor model [12] in 2015 to increase profitability and investment style factors, so as to better explain the excess return of the portfolio. The profit factors and investment factors are sorted and grouped respectively, and 18 groups are

obtained: weak profitability (W), medium profitability (o), good profitability (R), conservative investment style (c), stable investment style (n) and aggressive investment style (a).

$$RMW = \frac{SR+BR}{2} - \frac{SW+BW}{2} \qquad (3)$$

$$CMA = \frac{SC+BC}{2} - \frac{SA+BA}{2} \qquad (4)$$

2.2 Model setting

The setting model is as follows:

$$R_i - R_f = \alpha_i + b_i(R_M - R_f) + s_i SMB + h_i HML + r_i RMW + c_i CMA + \varepsilon_i \qquad (5)$$

3. Data source and measurement result analysis

3.1 Sample and data description

The data of this paper is selected from the public data source of Professor Kenneth R. French. In order to study the impact of the epidemic on the whole industry of US stocks, the daily data of 49 industry classification data are selected for empirical research. Since March 2020, the epidemic has spread on a large scale in the United States. The data from March to early November 2020 are selected as the data after the outbreak of the epidemic, and the data of the same length of time (July 2019 to March 2020) are selected as the data before the epidemic for comparison. Multiple linear regression method was used to calculate the data of 49 industries, and the overall five factor coefficient and significance level of the model before and after the epidemic, as well as the five factor coefficient and significance level for a single industry were obtained.

3.2 Regression analysis of 49 industries

3.2.1 Intercept item.

Before COVID-19, the T value of intercept entries reached 4 industries, namely, electronic equipment, coal industry, personal service industry and chip industry. It shows that before the epidemic, Fama French five factor model can not fully explain the stock returns of these four industries. After the epidemic, the T value of intercept terms in all industries is not significant, indicating that Fama French five factor model can well explain the stock returns of 49 industries.

3.2.2 Market factor, that is, the expected excess return of relatively risk-free investment in the market.

As shown in Figure 1, before the outbreak, there were 25 and 24 industries that were sensitive to asset price changes relative to market changes (coefficient > 1) and insensitive to market changes (coefficient < 1), respectively, which were roughly the same. The industries that are not sensitive to market changes are mostly those related to national daily consumption, industry and infrastructure construction. On the contrary, high-tech industries, financial industry, means of transportation, upstream and downstream related to construction and other industries deeply affected by macro-economy are more sensitive to market changes. After the outbreak, the number of industries with market factor coefficient < 1 rose to 31, and the importance of market risk premium factor decreased after the outbreak. At the same time, there is no industry whose market factor coefficient is < 1 before the epidemic and > 1 after the epidemic, that is, there is no industry

whose market factor weight increases after the epidemic.There are six industries with pre epidemic factor coefficient > 1 and post epidemic factor coefficient < 1, namely entertainment, clothing, medical care, mining, measurement and control equipment. For the above six industries, the epidemic has led to a decline in the explanation of stock returns by market factors. The negative impact of the epidemic is more, and the prospects of these industries are more affected by the development of the epidemic. Under the background of the outbreak of the epidemic, the medical and health care industry and the measurement and control equipment industry are easier to obtain the rapid improvement of profits.

3.2.3   Market value factor represents the expected excess return of small market value companies relative to large market value companies.

There were 26 industries with significant market value factor before the epidemic and 29 industries after the epidemic, which increased slightly, and the importance of market value factor increased. Among the industries with significant market value factors, traditional manufacturing accounts for the majority. Among the industries with significant market value factors after the epidemic, 22 have positive coefficients and 7 have negative coefficients. The market value factor of the pharmaceutical industry is significant before and after the outbreak, but the factor coefficients before and after the outbreak are 0.1976 and -0.1558 respectively, which shows that the market value factor is an important predictor of the excess return of stocks in the pharmaceutical industry. In the context of the epidemic, the pharmaceutical industry has high investment value and is attractive to institutional and individual investors. At this time, large market capitalization companies can accommodate a large amount of funds. After the outbreak, the factor coefficients of rare metals and catering and hotel industries have changed from negative to positive. The SMB factor coefficient of the three industries of drugs, computer hardware and shipping containers has changed from positive to negative, that is, the large market value combination obtains a higher rate of return.

3.2.4   Value factor is used to measure the excess return of value stocks over growth stocks.

There were 25 industries with significant value factors before the epidemic, and the number increased to 32 after the epidemic, indicating that the book market value expanded the scope of explaining the stock returns of the industry after the epidemic. We find that the value factor is more important in measuring the stock return of high-tech enterprises. There is no significant condition in which the factor coefficient is positive and negative. There are 25 industries with significant value factors after the outbreak, and the coefficient is positive. There are seven with negative coefficients. The coefficient of rare metals industry and automobile manufacturing industry has changed from positive to negative. There are 34 industries with increased market value factor coefficient, indicating that investors have a general preference for value stocks during the epidemic. The coefficients of textiles, personal equipment and catering and accommodation industries have changed from negative to positive.

3.2.5   Profitability factor.

There were 26 industries with significant profit factor RMW before the epidemic, but only 19 industries with significant profit factor RMW after the epidemic, which decreased significantly. The explanation of stock returns by profit factors in most industries decreased significantly. There were 14 industries with significant profit factors before and after the epidemic. Among the industries with significant profit factors after the outbreak, 11 have positive coefficients and 8 have negative coefficients, which are food, tobacco products, medical equipment, drugs, public utilities, banking, insurance and trade industries. The coefficient of construction 、 candy and soda 、

aluminum deep processing industry changed from negative to positive. The coefficient of plastic and rubber products industry changes from positive to negative .

3.2.6　Investment style factor.

There were 22 industries with significant investment factor CMA before the epidemic, and 27 industries with significant investment factor after the epidemic, which increased. The investment style factor before the epidemic was significant, and there were 7 industries that were not significant after the epidemic, and 12 industries that were not significant before the epidemic and significant after the epidemic. There are 15 industry investment factors that are significant before and after the epidemic, and there is no obvious style switching such as one positive and one negative when they are significant before and after the epidemic. After the outbreak of the epidemic, 17 industries with significant investment style factors had positive coefficients; There are 10 negative ones. The factor factors of coal, oil and gas mining, aluminum deep processing and steel industries have changed from negative to positive, and a conservative investment style can bring more excess returns. The investment factor coefficient of textile, medical care and construction industries has changed from positive to negative and into radical investment style.

4.　Main conclusions and suggestions

The empirical results show that: first, after the epidemic, the marginal effects of market risk factors and investment style factors on stock returns are weakened, while the marginal effects of market value factors and value factors are enhanced; The influence of profit factor on stock return is not significant. Second, after the epidemic, the market prefers small cap stocks, value stocks and investment portfolios with conservative investment styles. The portfolio of small market value and value stocks in the hotel and catering industry, the portfolio of high market value and growth stocks in the rare metal industry, and the portfolio of value stocks and aggressive investment styles in the textile industry gained more excess returns.

In the case of uncertain market prospects, investors can pay attention to: first, avoid panic, rationally look at the ups and downs of stocks, and reduce speculation. Second, paying attention to the value factor and market value factor to explain the role of stock returns can appropriately reduce the measurement of stock profitability. Third, adopt targeted investment strategies for each industry to obtain higher excess returns.

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