Analysis of Financial-related Industry During COVID-19 Based on the Fama-French Five Factor Model

Yin Yu*

Zhongyuan Bank Co., Ltd, Zhengzhou, 450000, China

*Corresponding author. Email: yu18703690959@163.com

Abstract. COVID-19 has had a huge impact on the global economy, and financial markets in particular have been hit hard. Based on the Fama-French five-factor model and multiple linear regression theory, this paper investigates the differences in investment directions in the U.S. banking, insurance, and trading sectors before and after COVID-19. The data in this paper are selected from Kenneth R. french's web-based database. after comparing the linear regression results for the two periods before and after COVID-19, it is found that COVID-19 had the greatest impact on the U.S. insurance industry, followed by the banking industry, while the impact on the trading industry was relatively insignificant. the findings suggest that the insurance industry needs to pay more attention to value stock investments after COVID-19, the banking industry still prefers to invest in higher market capitalization and larger companies after COVID-19 but does not need to consider the impact of operating profit indicators on the correlation of investment returns, and the trading industry needs to maintain its pre-COVID-19 investment preferences for companies with higher market capitalization, larger size, higher book-to-market ratio, and lower values of operating profit indicators, which can yield higher returns.

Keywords: Fama-French Five Factor Model, Financial-related Industry, COVID-19

1   Introduction

1.1   Background

COVID-19 has shaken many industries, increasing both economic volatility and financial market risk pressures. At the same time, the U.S. adopted a quantitative easing monetary policy after COVID-19 to promote the stabilization of financial markets. In the face of the changes in the external investment environment, how to better manage their wealth, better control investment risks, and obtain higher returns has become an urgent issue for investors. The importance of choosing the right investment direction and strategy is self-evident, and the right direction is the prerequisite for higher returns. This paper analyzes the impact of COVID-19 on financial-related industries and provides specific reference suggestions for investors through a study of changes in investor preferences in the U.S. banking, insurance, and trading industries before and after COVID-19.

1.2   Related Research

Huang et al. analyzed and demonstrated the impact of COVID-19 on Chinese finance, especially in terms of systemic risk, based on an event analysis approach. The research demonstrates the performance of different characteristics of the banking, securities, and insurance sectors in terms of systemic financial risk during COVID-19 and points out that the impact of COVID-19 on systemic financial risk in all sectors shows horizontal and trend effects, but in the overall financial system, the securities and real estate sectors not only contribute more to the growth of systemic risk than the banking and insurance sectors but are also more persistent [1]. Yan and Jia conducted an empirical analysis of the sustainability impact of COVID-19 on the banking and fintech industries through an OLS model after collecting relevant data. It found that the occurrence of COVID-19 significantly reduces the number of bank branches, on the one hand, promotes the development of fintech on the other hand [2].

Bashir, in order to study the impact of COVID-19 disease COVID-19 on stock returns and investment behavior in India, used a multiple linear regression model by examining the relationship between trading volume on the Bombay Stock Exchange and the number of daily COVID-19 cases and associated deaths, and found that the trading behavior of investors in the Indian stock market was not significantly affected by the spread of COVID-19 [3]. Cheng analyzed the relationship between the rate of

new infections and stock price volatility by using the ARDL bounds test on the collected data to analyze the impact of the COVID-19 pandemic on stock investments in China. It found that the rate of new infections was negatively related to stock prices in the short run during the initial year of the pandemic, while there was no clear evidence of a relationship in the long run [4]. Zhang uses the Fama-French five-factor model to analyze data related to 49 industries in the U.S. stock market before and during the COVID-19 pandemic. After multiple linear regressions of the correlated changes in statistical factors, the study finds that the Fama-French five-factor model fits the U.S. stock market better during the pandemic than before the pandemic [5].

Drawing on a variety of literature, Goodell describes the impact of a pandemic like COVID-19 on various aspects of the economy and society, financial markets, and institutional government. By examining relevant past events, he foresees the devastating impact of COVID-19 on the global economy and the next research topics that financial practitioners may face, such as the impact of COVID-19 on the cost of capital, pension plans, insurance, and the role of government in protecting the financial system [6].

Qin does a study on the applicability of the five factors in the A-share market based on selected monthly data of the Chinese A-share market (March 1999-April 2019) and finds that the five-factor model explains the A-share market better than the three-factor model and concludes that the A-share market excess returns are affected by the CMA factor through linear regression and GRS tests [7].

Zhang and Li construct the factor-increased vector autoregressive model proposed by Bernanke to portray the strength and pathway of the impact of COVID-19 on the financial industry and conduct an empirical study by factor analysis to find that the COVID-19 has significant effects on the financial market in the short term, mainly in terms of significant negative impact on the stock market, positive stimulus effect on the bond market, an increase in default risk and liquidity risk in the banking sector, and a relatively small negative impact on the insurance industry [8]. Wen et al. summarized a large amount of previous literature and collect relevant information on COVID-19 COVID-19, and then did a comparative analysis of the year-over-year and year-over-year operating income and net profit of some listed companies in the financial sector in March 2020. The study points out the impact of Newcastle pneumonia on the banking industry. On the one hand, COVID-19 will hurt the banking industry in the short term, mainly involving a downward spiral in credit

allocation preference risk, increased pressure on non-performing loans, and net interest margin facing narrowing; on the other hand, the COVID-19 will have a limited impact on banking business [9]. Luo et al. construct a multiple regression model of net profit to analyze the actual impact of COVID-19 on the financial industry by selecting financial panel data of 99 domestic financial listed companies before and after COVID-19 from 2019 to 2020. It found that the net profit growth rate of the banking industry decreased, while the securities industry still experienced year-on-year net profit growth [10].

1.3   Objective

Based on the Fama-French five-factor model, this paper aims to study the changes in the investment direction of financial-related industries before and after COVID-19 through linear regression analysis and to give feasible investment recommendations. Chapter 1 introduces the background of the study and the existing literature. Chapter 2 introduces the origin and content of the five-factor model, which is the basis of the study. Chapter 3 presents the results of the linear regression analysis and points out the changes in the five-factor coefficients of financial-related industries before and after COVID-19. Chapter 4 analyzes the reasons for the changes in the coefficients and gives corresponding investment recommendations, and Chapter 5 concludes the paper.

2   Method and Data

2.1   The Origin of the Fama-French Five-Factor Model (ff5f)

2.1.1. Capital Asset Pricing Model (capm).

The model was proposed by William, Lintel, and Mosin et al. based on asset portfolio theory and capital market theory, and focuses on the relationship between expected asset returns and risky assets in the securities market. The model has some shortcomings, such as the assumptions do not match the actual conditions; the risk-free assets and the market portfolio may not exist in practice; the estimated beta coefficient only represents the past variability, but the investor's concern is the future price variability of the security.

The basic form of this model is Rp=Rf+β(Rm - Rf), Rp is the expected return on the asset, Rf is the risk-free rate, β is the [Beta coefficient], and Rm is the expected market return on market m.

2.1.2. Arbitrage Pricing Theory (apt).

The model was proposed by Ross (1976), who stated that asset prices are influenced by a variety of factors but did not give specific factors that drive asset prices.

The basic form of this model is:

$$E(ri)= Rf+\beta 1 * Rp1+\beta 2 * Rp2+\ldots+\beta n * Rpn \qquad (1)$$

E(ri): expected return on the asset, Rf: risk-free rate, β: sensitivity of the asset price to macroeconomic variables; Rp: risk premium associated with the factor。

2.1.3. Fama-French 3-Factor Model (ff3f)

. Fama and French proposed that stock returns can be explained by a three-factor model, which is: the market factor, the size factor, and the value factor. The basic form of this model:

$$R_i\text{-}R_F=\beta_M (R_M - R_F）+\beta_{sMB}(SMB)+\beta_{HML}(HML) \qquad (2)$$

Ri is the expected return of the portfolio; RF represents the risk-free rate of return; RM represents the market return; SMB represents the market capitalization factor; and HML represents the book value factor. Small Minus Big (SMB), represents the market capitalization premium, which is the difference between the earnings of a small company and those of a large company. High minus Low (HML), the value factor, represents the growth opportunity premium of the firm, and the difference between the earnings of a high book-to-market company and the earnings of a low book-to-market company.

2.2   Fama-French Five-Factor Model (ff5f)

In 2015, Fama and French added two factors - profitability and investment - to the three-factor model. The five-factor model (FF5F) takes into account more financial factors and performs better than the original three-factor model in assessing risk in the cross-section of stock returns. The basic form of this model:

$$R_i-R_F=\beta_M(R_M-R_F)+\beta_{sMB}(SMB)+\beta_{HML}(HML)+\beta_{RMW}(RMW)+\beta_{CMA}(CMA)+e_i \quad (3)$$

RMW is a profitability factor, which is the difference between the returns of a portfolio of stocks with high operating margins and a portfolio of stocks with low operating margins. The difference between a portfolio of stocks with high operating margins and a portfolio of stocks with low operating margins reflects the premium of the high-yielding stock portfolio to the low-yielding stock portfolio.CMA is an investment style factor, which is the difference between the returns of conservative and aggressive stock portfolios.

3   Results

The data in this paper are selected from Kenneth R. French's web database, as well as information about the U.S. stock market. This research analyzes data from the financial sector in three areas: banking, insurance, and transaction-based industries. Table I is used to calculate the coefficients through multiple linear regressions.

Table 1. Calculation results of the financial industry before and during COVID-19

Industry	Factor	Before (2019.5.15-2020.3.6)		During(2020.3.7-2020.11.18)	
		Coefficients	t Stat	Coefficients	t Stat
Banks	RM-RF	1.14	52.81	1.07	43.03
	SMB	-0.12	-2.76	-0.14	-2.24
	HML	0.77	16.89	1.06	20.33
	RMW	-0.33	-4.36	-0.19	-1.73
	CMA	-0.36	-4.04	-0.53	-3.67
Insurance	RM-RF	1.10	27.53	1.04	32.40
	SMB	-0.20	-2.36	-0.09	-1.07
	HML	0.13	1.59	0.39	5.76
	RMW	-0.40	-2.83	-0.33	-2.26

	CMA	0.52	3.16	-0.06	-0.30
Trading	RM-RF	1.06	35.60	1.10	48.97
	SMB	-0.13	-2.16	-0.16	-2.77
	HML	0.48	7.65	0.52	11.07
	RMW	-0.45	-4.29	-0.54	-5.33
	CMA	-0.15	-1.25	-0.01	-0.11

3.1   Before Covid-19

Firstly, for the banking industry, RM - RF, SMB, HML, RMW, and CMA factors are all significant according to the t-statistics. For the insurance industry, RM - RF, RMW, and CMA factors are significant, but SMB and HML are redundant factors, which have no validity in the calculation of return on investment. RM - RF, SMB, HML, and RMW factors are significant for the trading industry, while CMA is a redundant factor.

Secondly, for the banking industry, the insurance industry, and the trading industry, since the coefficient of RM - RF is all greater than 1, it indicates that the financial industry is more sensitive than the overall market. Meanwhile, the values of HML in these three industries are greater than 0, indicating that the market tends to favor small-cap companies. But in three areas, only the insurance industry has a CMA value greater than 0, which indicates a conservative investment style can yield more return than an aggressive investment style.

3.2   During Covid-19

For the banking industry, only the RMW factor is redundant, while the other four factors are significant according to the t-statistics. For the insurance industry, RM - RF, HML, and RMW factors are significant, but SMB and CMA are redundant factors. For the trading industry, RM - RF, SMB, HML, and RMW factors are significant, but only CMA is a redundant factor.

In addition, only the value of CMA in the insurance industry changed from greater than 0 before COVID-19 to less than 0, which indicates that an aggressive investment style can yield more return than a conservative investment style after the outbreak of COVID-19.

4   Discussion

4.1   Bank

4.1.1. RMW.

Before and after COVID-19, the correlation of factor RMW for high investment returns changes from significant to insignificant, indicating that when investing in the banking sector after COVID-19, the operating profit indicator does not have a significant impact on investment returns.

The impact of COVID-19 on the whole financial sector is more general. On the one hand, under the impact of COVID-19, the banking industry focused more on sound compliance and risk prevention and resolution, and became more prudent in loan placement, while banks increased provisioning, and the overall net profit margin of the industry showed a narrowing trend; therefore, the degree of influence of operating profit margin on the high and low returns obtained from investments decreased or even was not as obvious as before the COVID-19.

The four largest U.S. banks (JPMorgan Chase, Citibank, Bank of America, and Wells Fargo) made a combined provision of RMB 403.3 billion in the first half of 2020, a fivefold increase compared to the same period last year. Wells Fargo had the highest increase, with the scale of provisioning in the first half of the year increasing nearly 10 times compared to the same period last year, while the other three increased between 2-7 times.

On the other hand, COVID-19 is prone to financial crisis and prone to mergers and acquisitions, as banks severely affected by COVID-19 will actively take measures to improve their balance sheet positions and focus on optimizing capital adequacy by disposing of non-core businesses or non-performing assets, investment portfolios and business segments, etc. Moreover, mergers and acquisitions can accelerate the digitalization and transformation of companies, and therefore strategic and speculative mergers and acquisitions occur. At the same time, investors' expectations of this situation have increased.

In the second half of 2020, frequent cases of M&A in the banking sector were exposed, such as the announcement of an agreement between US financial firm PNC (Pittsburgh National Corporation) and Spanish foreign bank BBVA (Banco Bilbao Vizcaya Argentaria, S.A.) to acquire BBVA's US subsidiary (BBVA) for US$11.6 billion (approximately R$76.4 billion). USA Bancshares) for $11.6 billion

(approximately RMB 6.4 billion). The all-cash deal is the second-largest U.S. banking acquisition deal since the 2008 financial crisis. Huntington Bank (HBAN.US) announced plans to acquire TCF Financial Corp (TCF.US) for $6 billion, an 11.6% premium to TCF's share price before the announcement of the acquisition.

4.1.2. CMA and SMB.

The coefficient values of the factors CMA and SMB are negative before and after COVID-19, indicating that investments with higher market capitalization, larger scale, and more aggressive style are more likely to yield higher returns.

The economy determines finance, and banks, as the cornerstone of finance, are mainly focused on capital, the larger the bank, the more capital, the stronger the risk resistance, and the relatively better investment returns.

The operating conditions of different sizes and types of banks in the U.S. banking industry under COVID-19 are seriously divergent. For large banks, their diversification is more resilient to risk, with investment banking and trading income contributions offsetting to some extent the rise in provisions and decline in interest income. For community banks, fee income under PPP became one of the main sources of their revenue in 2020, according to Federal Reserve statistics, and a significant portion of community banks had negative new loan volume other than PPP loans. As for other small and medium-sized banks, they are less able to diversify their business and suffer the most severe impact from the new crown crisis.

4.1.3. HML.

The value of the factor HML coefficient is greater than 0 before and after COVID-19, indicating that the investment industry tends to profit more from companies with high book value. While companies with low value are growth stocks with lower risk and lower returns.

As a leader in risk management in the financial industry, the balance sheet of banks is mainly composed of assets with different liquidity, so book value is a good proxy for the value of bank stocks.

4.2   Insurance

4.2.1. SMB.

The correlation of factor SMB changes from significant to insignificant for the market capitalization factor after COVID-19, indicating that there is no need to consider the impact of the company size factor on investment returns after COVID-19.

Affected by COVID-19 prevention and control and other measures, insurance companies cannot continue their traditional business model and are forced to shift to telecommuting and interacting with customers through the Internet, which makes online insurance develop rapidly and dilutes the public's concern about the size of insurance companies to a certain extent. At the same time, there are cases where small insurance companies, taking into account the COVID-19 situation, launch COVID-19-related insurance policies to cater to the public's health concerns and gain a certain market. In particular, Internet insurance companies have the advantage of flexibility in the rapid follow-up and implementation of emerging technologies, which will become a booster for the industry to explore emerging technologies and novel models and activate the innovative vitality of the industry.

The Federal Reserve announced an "unlimited" quantitative easing policy in late March 2020 to ease the instability of its economy after the COVID-19 of Newcastle pneumonia. Quantitative easing has raised consumer inflation expectations, which is expected to increase consumer demand for participating insurance and boost capital markets in favor of providing a return on investment of insurance funds.

4.2.2. HML.

The correlation of factor HML changes from insignificant to significant for high or low book value after COVID-19, suggesting that investing in value stocks can lead to higher returns when investing in the insurance sector after COVID-19.

Aggressive quantitative easing policies have driven asset prices out of sync with the real economy and risky asset prices have generally risen more than safe assets. At the same time, COVID-19 has challenged the payout capacity, liquidity and profitability of insurance companies, triggering pressure on financial indicators of insurance companies, which is not conducive to the development of the overall growth momentum of the insurance industry, so choosing value stocks can lead to relatively quick gains while choosing growth stocks is subject to greater uncertainty risk.

4.2.3. CMA.

The correlation of the factor CMA for investment style changed from significant to insignificant after   COVID-19, indicating that there is no significant preference for aggressive and conservative investment styles in the insurance industry after COVID-19.

The occurrence and spread of the new crown disease have led to a growing concern about life insurance, which in turn is reflected in expected returns. According to Google Trends, searches for "life insurance and neo-coronavirus" have increased by 250% online.

Before COVID-19, the insurance industry tended to adopt a conservative investment strategy to reduce the industry's business risk, while the impact of COVID-19 on the insurance industry was comprehensive and profound, with no significant difference between conservative or aggressive investment styles that could effectively respond to the impact of COVID-19's claims.

4.3   Trading

4.3.1. Reasons for no Change in Factor Significance.

The trading industry was less affected by COVID-19, which may be related to the quantitative and accommodative monetary policy and the structural bull market in U.S. stocks.

Quantitative, accommodative monetary policies have allowed trading markets to show no significant volatile changes after COVID-19. As a result of the new crown COVID-19, countries launched quantitative easing monetary policies one after another to hedge against economic downward pressure. The U.S. took the lead in launching $2.3 trillion in quantitative easing bailout funds. Since the COVID-19 of the COVID-19 the Federal Reserve has gradually normalized QE, the Dow Jones index from the low of 18213 in March this year took less than six months and rose to the recent 28400 points of the core driving force, while the Nasdaq Composite Index and the S&P index also hit a record high. With the Federal Reserve's implementation of a series of rescue measures, late March to mid-April stock market, bond market, and money market partly restore stability and normal function, liquidity crisis relief.

The macro environment of economic expansion and low-interest rates brought about by quantitative easing monetary policy also further promoted a structural bull market in U.S. stocks. Because the whole process is a phase in which the rhythm of

GDP growth gradually moves upward or stabilizes, i.e., the economic fundamentals move upward or turn better, the fundamentals and macro environment make the structural bull market in U.S. stocks persist.

4.3.2. Relevant Factor Situation.

Market Risk Premium RM - RF, coefficient values are close to 1, indicating that the trading industry is close to the market volatility.

The trading industry is the "barometer" of the financial market. For the trading market, it is the uncertainty and volatility that brings investment opportunities, and the trading industry has been maintaining market sensitivity.

The values of SMB, CMA and RMW coefficients are less than zero, which means that investors expect better investment returns for companies with higher market capitalization, larger size and lower operating margins in the trading industry.

Companies with high market capitalization and large sizes are relatively more resilient to risk. Operating margin is primarily the total revenue of the previous fiscal year less the cost of main operations, interest expense and selling, general and administrative expenses, divided by the total book equity at the end of the previous fiscal year. The measure of investment, on the other hand, is mainly the increase in total assets in the previous fiscal year relative to the previous fiscal year, divided by the number of total assets at the end of the previous fiscal year. A lower operating profit margin implies a large total asset base for the company, and investors have relatively higher market expectations for this type of company.

The HML coefficient value is greater than 0, indicating a preference for investing in companies with high book-to-market ratios.

These companies are relatively traditional and asset-heavy, which also means that they have more tradable operating assets and cash, and thus have relatively stronger risk resistance and business expansion opportunities, with previously undervalued market capitalization and better market expectations, and investors are willing to pay a premium for market expectations, which tend to grow under the quantitative easing monetary policy.

5   Conclusion

This paper examines the changes in the five coefficients in the Fama-French five-factor model for the banking, insurance, and trading sectors before and after

COVID-19, and analyzes the empirical data to find that the COVID-19 has a greater impact on the insurance and banking sectors, while the impact on the trading sector is relatively insignificant. Accordingly, the next investment direction should be changed and adjusted.

For the banking industry, after COVID-19, it is still necessary to maintain investment focus on companies with high market capitalization and large scale, and aggressive investment style can still bring higher returns, but the operating profit index has an insignificant impact on investment returns after the COVID-19; for the insurance industry, after the COVID-19, the impact of company size and investment style factors on investment returns changed from significant to insignificant, but the correlation between high and low book value changed from insignificant to significant. However, the correlation between high and low book value changes from insignificant to significant, indicating that investing in value stocks can bring higher returns after COVID-19; for the trading industry, companies with higher market capitalization, larger size, higher book value, and lower operating profit indicators can still obtain higher returns.

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