The Nirvana of the US Clothing Industry After COVID-19
Based on the Fama-French Five-Factor Model

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ABSTRACT

In 2020, the global spread of COVID-19 has brought a huge impact to the international financial market and destroyed many industries. This paper applies Fama-French five-factor model to analyze the effect of COVID-19 on the clothing industry. Based on the data from Kenneth R. French's database, this paper selects the daily five-factor data of the US clothing industry. Considering the outbreak point of March 1, 2020 as the dividing line, and take the nine months before (2019.06-2020.02) and during (2020.03-2020.11) as the research object, respectively. The results of the study show that the Fama-French five-factor model has increased its interpretation after COVID-19, and the market factor has changed less. The epidemic has caused small-scale effects in the clothing industry, and investors are more inclined to invest in high book-to-market value ratio stocks. RMW becomes insignificant so that the speculative nature of clothing industry stocks has decreased. The CMA factor is redundant before and after the epidemic. Investors should pay more attention to the companies with small-scale, value stock and good profitability.

Keywords: Fama-French model, COVID-19, clothing industry, US stock market.

1. INTRODUCTION

Asset pricing has always been a hot topic in the financial field. With the deepening of the research, its theoretical model has undergone many evolutions. In the beginning, Harry Markowitz took the lead in putting forward the asset portfolio theory, using the mean-variance analysis method to select the optimal investment portfolio [1]. Later, Willian Sharp developed it into a capital asset pricing model, namely the CAPM model [2]. The single-factor model of CAPM mainly studied the relationship between the expected return on assets in the securities market and the risk, and believed that it was the unsystematic risk that affected the return on stocks. Since then, many studies have validated that CAPM cannot explain some abnormal phenomena other than system factors, and its explanation of stock returns was not strong enough. Arbitrage pricing theory (APT) emerged at the historic moment [3]. As an extension of CAPM, APT was based on a multi-factor model. It was believed that arbitrage is an important determinant of the formation of market equilibrium price. Furthermore, in 1992, Fama and French proposed the Fama-French

three-factor model based on APT, adding the scale factor and the book-to-market value ratio factor to more accurately predict the expected excess return of the investment portfolio [4]. In 2015, Fama and French added the profit factor and the investment factor to the framework of the original three-factor model, and further improved the five-factor model to better describe the expected return rate of the portfolio in the cross-section [5]. In the international capital market, the empirical test results of the five-factor model are generally better than the three-factor model and have been widely used.

In 2020, the global spread of the once-in-a-century new crown pneumonia epidemic (COVID-19) has brought a huge impact on the international financial market. From March 9 to 18, 2020, the US stock market experienced 4 circuit breakers unprecedentedly. What followed was that the annualized quarterly rate of US GDP fell to -31.7% in the second quarter, and the unemployment rate soared to 14.7% in April, setting a new high since the Great Depression in the 1930s. As the labor market deteriorated rapidly, the impact of income effects began to cause a sharp decline in consumer spending and a sharp deterioration in

confidence. The stock bull market in recent years has caused the ratio of net assets/disposable income to continue to rise from 6 in the crisis to 6.9, making the wealth effect affect consumer spending beyond the income effect. At the same time, financial assets accounted for a large proportion of personal pensions in the United States. As the baby boomers retired one after another, expenditures accounted for an increase in their consumption expenditures. The elasticity coefficient of consumer spending to price changes such as financial assets was 13.3 basis points. Therefore, when the stock market and other markets were substantially reduced by the impact of the epidemic, not only would the market's expectation for the future economic prospects decline, but it would also directly impact the consumption of American residents. The economy was severely affected.

After the outbreak of COVID-19, many scholars have conducted research on the influence on the capital market. Yilmazkuday investigated the impact of COVID-19 cases in the United States on the S&P 500 index. The structural vector autoregressive model was used in the article to cover the daily data from January 21, 2020 to August 6, 2020, as well as the measurement of the spread between the fixed term of the 10-year Treasury bill and the federal funds rate. The empirical results suggest that in the United States, the increase in the number of COVID-19 cases exerted a negative impact on the S&P 500 index [6]. Ali et al studied the influence of COVID-19 on financial risks from the perspective of global financial market recession and volatility. This paper expanded the scope of research to markets such as stocks, bonds, Bitcoin, gold, and oil. The research results showed that China's financial market is relatively stable during the limited contagion phase and the pandemic phase. And also, the gold market has the smallest volatility among all markets [7]. Onali investigated the impact of COVID-19 cases and related deaths on the US stock market (Dow Jones and S&P500 indices). This article expanded the scope of research to seven countries including the United States, China, France, the United Kingdom, Iran, Italy and Spain. Based on a GARCH(1,1) model and data from April 8, 2019 to April 9, 2020, the results suggested that COVID-19 had significantly affected the volatility of the stock market [8]. Albulescu studied the impact of COVID-19 on financial stability by using different kinds of data, including daily increase cases, mortality rates, economic policy uncertainties and other data of China and other countries and economies. This research revealed that newly confirmed cases in countries and economies other than China had a significant positive relationship with financial volatility, and the higher the mortality rate, the greater the financial volatility [9]. Goodell highlighted the enormous economic and social impact of COVID-19. By comparing the major emergencies in history, it analyzed the direct or indirect impact of COVID-19 on the economic and financial markets, the banking sector, the government, the public and society. Considering the characteristics of COVID-19 and the results of the research, the epidemic may even permanently lead to changes in financing structure and financial market rules, and in turn affect financial volatility [10].

Moreover, the Fama-French model is adopted to evaluate the effect of an epidemic, Dominik and Wang studied the application ability of the Fama-French model in the American stock market by evaluating the R^2 of the models. They found that R^2 of the growth model is statistically significant under the influence of the Dotcom bubble and R^2 of growth portfolios fell sharply during the Financial crisis of 2008. They also found the decrease of R^2 was more obvious due to COVID-19 so that the explanatory power of the model was reduced [11]. Baig et al investigated the effect of the COVID-19 pandemic on the microstructure of the US stock market. They analyzed 48 Fama-French sub-sectors by capturing indices of multiple dimensions of the pandemic to explain liquidity and volatility dynamics. The results suggested that the increase in confirmed cases and deaths due to COVID-19 is significantly associated with increased market liquidity and volatility [12]. Lee studied the initial impact of COVID-19 sentiment on the US stock market. By using the Daily News Sentiment Index (DNSI) and Google Trends data on coronavirus-related searches, Lee examined whether the change in DNSI since January 21 had a difference in predicting industrial returns in the United States. The results of this study showed that the excess returns are obtained from the Fama-French three-factor model [13].

As mentioned above, the Fama-French model is a relatively reliable asset pricing model and can be used in many fields. To better grasp the impact of influencing factors on asset pricing in different industries during COVID-19, in addition to exploring the overall stock market, it is also necessary to explore the impact of different factors in the stock market by industry. Currently, there are few pieces of research about studying the impact of COVID-19 on specific industries. Therefore, based on the Fama-French five-factor model, this study takes the US stock clothing industry as an example to analyze the impact of COVID-19 on the industry's returns, aiming to provide empirical evidence and experience for the asset pricing of the US clothing industry's capital market.

2. METHOD

The Fama-French three-factor model was proposed by Fama and French to explain the difference in stock returns. The three-factor model believed that the excess return $E(R_i)$-R_f of the portfolio would be explained by three factors, the excess return $E(R_m)$-R_f of the market,

the company's market value and the book-to-market value ratio. Among them, Fama and French regarded the company's market value as the size factor SMB, and book-to-market value ratio as the book-to-market value ratio factor HML and introduced these two factors into the capital asset pricing model CAPM to improve it.

The five-factor model was based on the consideration of the dividend discount model, and the company's profitability and investment style factors were added to the three-factor model. Among them, Fama and French regarded company earnings as the profit factor RWM and investment style as the investment factor CMA.

Three-Factor model:

$$E(R_i) - R_f = \beta_{MKT}[E(R_m) - R_f] + \beta_{SMB}SMB + \beta_{HML}HML + \varepsilon_i \tag{1}$$

Five-Factor model:

$$E(R_i) - R_f = \beta_{MKT}[E(R_m) - R_f] + \beta_{SMB}SMB + \beta_{HML}HML + \beta_{RMW}RMW + \beta_{CMA}CMA + \varepsilon_i \tag{2}$$

In the equations, $E(R_i)$ is the expected rate of return of the investment portfolio, R_f is the risk-free rate of return, $E(R_m)$ is the expected rate of return of the market portfolio, and $E(R_m)-R_f$ is the market risk premium factor.

SMB (small minus big) is a scale factor that describes the excess return of market value risk. The calculation method is that first sorts all the stocks in the market according to market value, and then divides them into three equal parts. The first one is large-market value stock (the largest 1/3 of all stocks), the second one is medium-value stock, and the third one is small-market value stock (the smallest 1/3 of all stocks). Let the average expected rate of return of small-market value stock be $E(r_S)$, and the expected rate of return of large-market value stock be $E(r_B)$. Then SMB = $E(r_S)$ - $E(r_B)$.

HML (high minus low) is a book-to-market value ratio factor that describes the company's additional financial distress risk. The calculation method is that first sorts all the stocks in the market by B/M, and then divides them into three equal parts. The first one is high B/M stock (the largest 1/3 of all stocks), the second one

is medium B/M stock, and the third one is low B/M stock (the smallest 1/3 of all stocks). Let the average expected rate of return of high B/M stock be $E(r_H)$, and the expected rate of return of low B/M stock be $E(r_L)$. Then HML = $E(r_H)$ - $E(r_L)$.

RMW (robust minus weak) is a profit factor that describes the company's profitability risk. Fama and French used ROE to measure the company's profitability. The calculation of RMW is similar to SMB and HML. It also divides all the stocks into three parts and then calculates the difference between the expected return of stocks with robust and weak profitability.

CMA (conservative minus aggressive) is an investment factor that describes the company's investment style. Fama and French used the reinvestment ratio which was calculated by the annual growth rate of total assets to measure investment level. The calculation of CMA is similar to SMB, HML and RMW. It also divides all the stocks into three parts, and then calculates the difference between the expected return of stocks with conservative and aggressive investment style.

3. RESULTS

The data in this article is selected from Kenneth R. French's data, which is obtained by French, the founder of the Fama-French model, based on relevant information in the US stock market. To compare the effect of COVID-19, this paper selected daily data of the clothing industry. Given the large-scale spread of COVID-19 in the United States in March 2020 and the completion of vaccine development in November 2020, we chose the data from March to October as the data after the outbreak of COVID-19. At the same time, the data of the same length of time (June 2019 to February 2020) were selected as a reference for comparison before the epidemic. Using multiple linear regression method to analyze the data of the clothing industry, the coefficients of the five-factor model before and after the epidemic were obtained and the significance test was performed. The results are shown in the following table 1 and table 2, where * represents significance at the 5% significance level.

Table 1. REGRESSION RESULTS BEFORE COVID-19 (2019.06-2020.02)

Time	Item	Five-Factor Model				
		$E(R_m)$-R_f	SMB	HML	RMW	CMA
2019.06-2020.02	Coefficient	1.032*	0.091	0.055	0.719*	0.071
	T test value	17.343	0.820	0.479	3.827	0.325

Table 2. REGRESSION RESULTS AFTER COVID-19 (2020.03-2020.11)

Time	Item	Five-Factor Model				
		$E(R_m)-R_f$	SMB	HML	RMW	CMA
2020.03-2020.11	Coefficient	0.972*	0.281*	0.264*	0.260	-0.359
	T test value	23.197	2.528	2.914	1.355	-1.490

From Table 1 and Table 2, it is evident that β_{MKT} becomes slightly smaller after the pandemic, which shows that the clothing industry stocks' price changes are less sensitive to the market than before. The SMB factor becomes significant after the pandemic, revealing that investors prefer to put their investments into small companies after COVID-19. Also, HML tends to be significant after the pandemic, which manifests that companies with high book-to-market ratios have higher returns. In addition, compared with before, RMW becomes insignificant, that is, the speculative nature of clothing industry stocks has decreased. What's more, CMA is not significant in this model so that the pandemic had no apparent effect on CMA.

4. DISCUSSION

4.1. MKT

β_{MKT} of the clothing industry decreases from 1.032 to 0.972, indicating that the sensitivity of the clothing industry to the market did not change a lot. During the epidemic, the US stock market was severely hit by COVID-19. As of the close of March 31, among the three major US stock indexes, the Dow Jones Industrial Average fell by 13.74% in March, setting the largest monthly decline since October 2008; in terms of quarterly data, it fell by 23.2% sharply; the S&P 500 Index also recorded its largest monthly and quarterly decline since the 2008 financial crisis. According to a new study from the University of Missouri, COVID-19 has hit the clothing industry particularly hard [14]. A McKinsey & Company study showed that due to financial market turmoil, supply chain disruption, and the collapse of consumer demand in the global economy, the average market value of companies in the clothing industry (the company value calculated by multiplying the current share price by the total number of shares) has fallen by nearly 40% [15]. According to a survey published by Optimum, due to the burden of COVID-19, approximately 38% of American adults intended to reduce their consumption of clothing and fashion goods [15]. Based on data released by the Bureau of Economic Analysis (BEA), consumer spending on clothing and footwear moved down by 1% to $407.71 billion in February compared to $403.67 billion spent in January [16]. "Because people have been staying inside, they haven't been going outside, they haven't been going on vacation or even parties. People didn't need as much trendy wear and have been relying more on comfort and longevity [14]." The decline in the demand for clothing

has a major impact on the clothing manufacturing industry. Many clothing retailers have to close their stores to protect customers and employees [17]. All the above had a profound impact on the clothing industry, causing the sensitivity of the clothing industry to the market to decrease.

4.2. SMB

The SMB factor turns to be significant after the pandemic. In the clothing industry, investors tend to invest in small-cap stocks during COVID-19 because of their higher yields. According to the small-scale effect, a company with a relatively small market capitalization is usually smaller in scale, and the company is relatively less stable, so the risk is greater, and investors need to obtain higher returns to compensate. According to consultants at McKinsey, the COVID-19 crisis has left consumers with little interest in flaunting in-your-face bling [15]. Andrea Felsted writes, "What is perceived as unethical behavior – or simply ugly consumerism – could turn off customers, especially younger shoppers who are particularly conscious of brands' social values [15]." For example, when COVID-19 began to hit the clothing industry, Calgary-based clothing store Madame Premier didn't put its business in the first place. All its Instagram posts were dedicated to COVID-19 safety tips. It wanted to give its customers space to deal with the disaster at hand, which was very different from what other large retailers did. Also, Madame Premier collaborated with another local company, Sophie Grance, to release four limited-edition T-shirts that feature artistic portraits of top public health officials. These shirts align with Madame Premier's core values of supporting increased diversity and inclusion of women in politics. Net proceeds of these shirts, which ended up amounting to $27000, were donated to charities in the doctors' provinces. Just like Madame Premier, local companies such as Sophie Grace and Smoking Lily have also begun to donate face masks to do charity. The modern world has never faced a global pandemic of COVID-19. COVID-19 has caused consumers to take a serious look at their values, making consumers choose to support small local companies to help. In summary, investors were more inclined to invest in small-cap companies despite the potential threat of radicalness and instability during the epidemic.

4.3. HML

The HML factor's coefficient tends to be significant after the pandemic, which implies that the

book-to-market ratio becomes essential for the investors in the clothing industry and investors prefer to buy value stocks instead of growth stocks. Although the demand for new clothing has fallen, the demand for personal protective equipment (PPE) is all-time high. Some apparel manufacturers have switched to the production of PPE to help meet this demand. Companies like Gildan, Hayne Brands and Merrow Manufacturing have responded to the extremely high demand for PPE by producing protective gowns and face masks to be distributed to healthcare workers [17]. While working with people to fight the epidemic, this behavior improved the company's social status and brand value. Investors believe that the corporate value of such companies will rise during the epidemic. Therefore, compared with growth stocks, investors are now more willing to focus on value stocks.

4.4. RMW

RMW becomes insignificant compared with before, that is, profitability doesn't have a significant effect on investment in the clothing industry after the pandemic. The situation of the clothing industry during COVID-19: due to a sharp sudden decline in consumer demand, many brands and retailers were sitting on a huge inventory of clothing from the Spring/Summer 2020 season. This inventory would lose most of its value over the next couple of months and be removed from full-price retail stores by the late summer [18]. According to the report of McKinsey & Company, based on the positions for earnings before interest, taxes, depreciation, and amortization (EBITDA), 75 percent of publicly listed apparel and fashion companies in North America could find themselves with negative EBITDA or untenable net debt-to-EBITDA ratios after three-month store closures. Depending on their cash positions, these companies would be in deep financial distress unless they take urgent actions [19]. In terms of physical retail, physical retail has been under historic levels of pressure. In the US, some 20000 to 25000 stores were expected to close in 2020, more than double the number that did so in 2019. In 2020, Nike announced the acceleration of its digital strategy and investment in its highest potential areas, which it said would lead to job cuts in stores [20]. All of the above signs indicate that the overall profit of the clothing industry has declined during the COVID-19 period, and the profitability has been frustrated.

4.5. CMA

The CMA factor is redundant before and after COVID-19, which means that the company's investment style doesn't have significant effects on investment in the clothing industry. The pattern of the US clothing industry is relatively stable. Leading companies in the clothing industry still maintain their leading positions,

such as Nike, Old Navy, Gap, VF Corporation, and L Brands. Their revenues in 2019 were 37.2, 16.6, 16.6, 13.8 and 13.2 million dollars respectively [21], ranking among the top five in the industry, far ahead of other companies. Especially Nike, with schools, brick-and-mortar fashion stores, and workplaces shut down, almost a quarter of Americans chose athleisure clothing as a top-three category of how they intended to spend their stimulus check [22]. Sport lifestyle is 1 of the top 3 footwear classes identified as contributors to potential incremental footwear sales growth through 2021. 37% of consumers say they are extremely or very interested in purchasing a customized, self-designed pair of footwear [23]. According to industry trends, Nike became the world's leading clothing brand in 2020, valued at nearly 35 billion U.S. dollars [24]. Nike has seen incredible growth during the pandemic. Although some start-ups are also developing very fast, the gap between giants and start-ups is still drastic.

5. CONCLUSION

Based on the Fama-French five-factor model, this article analyzes the difference between the clothing industry in the United States before and after COVID-19. The results show that the Fama-French model has strengthened the interpretation of the industry after the epidemic, and the epidemic has had a significant impact on the clothing industry.

First of all, the stock yields of the US clothing industry are positively correlated with market yields, and the clothing industry stocks' price changes are less sensitive to the market than before. The main reason may be that people stay at home during COVID-19 so that the demand for fashionable clothes decreases. The clothing industry companies have suffered setbacks.

Secondly, the SMB factor has become significant after the epidemic, which shows that there is a small-scale effect in the US clothing industry. Most small-scale stocks are in the growth stage and have a large room for development. Other small companies can learn from the practices of Madame Premier, Sophie Grance, Smoking Lily and other companies during the epidemic, and actively assume social responsibility, establish brand values and corporate images.

Thirdly, in the US clothing industry, stocks with a high book-to-market value ratio show a certain book-to-market value ratio benefit, which shows that the investment value of these companies is relatively high. This inspires companies in the clothing industry to establish a sense of social responsibility and seek opportunities for value growth in the epidemic. It also brings confidence to the society and financial markets, just like Gildan, Hayne Brands and Merrow Manufacturing.

Finally, RMW becomes insignificant compared with

before. Profitability doesn't have a significant effect on investment in the clothing industry after the pandemic. At the same time, the investment style (CMA) of the clothing industry companies don't significantly differ throughout the pandemic by using the Fama-French five-factor model.

REFERENCES

[1] Markowitz, Harry. Portfolio selection[J]. The Journal of Finance, 1952, 7(1).

[2] SharpeW. Capital asset prices: A theory of capital market equilibrium under conditions of risk[J]. Journal of Finance, 1964, 19.

[3] Stephen, A, Ross. The arbitrage theory of capital asset pricing[J]. Journal of Economic Theory, 1976, 13(3).

[4] Fama E F, French K R. The Cross-Section of Expected Stock Returns[J]. Journal of Finance, 1992, 47(02): 427-465.

[5] Fama E F, French K R. A Five-factor Asset Pricing Model[J]. Journal of Financial Economics, 2015, 116(01): 1-22.

[6] Yilmazkuday H. COVID-19 effects on the S&P 500 index[J]. Available at SSRN 3555433, 2020.

[7] Ali M, Alam N, Rizvi S A R. Coronavirus (COVID-19) – An epidemic or pandemic for financial markets[J]. Journal of Behavioral and Experimental Finance, Elsevier, 2020: 100341.

[8] Onali E. COVID-19 and stock market volatility[J]. Available at SSRN 3571453, 2020.

[9] Albulescu C. Coronavirus and financial volatility: 40 days of fasting and fear[J]. arXiv preprint arXiv: 2003. 04005, 2020.

[10] Goodell J W. COVID-19 and finance: Agendas for future research[J]. Finance Research Letters, Elsevier, 2020: 101512.

[11] Dominik Horv á th, Wang Y L. The examination of Fama-French Model during the Covid -19[J]. Finance Research Letters, 2020.

[12] Baig A, Butt H A, Haroon O, et al. Deaths, Panic, Lockdowns and US Equity Markets: The Case Of COVID-19 Pandemic[J]. Finance Research Letters, 2020.

[13] Lee H S. Exploring the Initial Impact of COVID-19 Sentiment on US Stock Market Using Big Data[J]. Sustainability, 2020, 12(16).

[14] University of Missouri. "Analyzing COVID-19's effect on the clothing industry." 2021, April 30. https://phys.org/news/2021-04-covid-effect-industr

y.html

[15] KENDALL BISTRETZAN. "The future of fashion: How COVID-19 is changing the industry." 2020, October 28. https://calgaryjournal.ca/2020/10/28/the-future-of-fashion-how-covid-19-is-changing-the-industry/

[16] Fiber2Fashion. "Impacts of COVID-19 on US Textile & Clothing Industry." 2020, April. https://www.fibre2fashion.com/industry-article/8646/impacts-of-covid-19-on-us-textile-clothing-industry

[17] Business Wire. "COVID-19's Impact on the Clothing Industry - Some Retailers Are Cancelling Orders Out of Fear They Will Be Left With a Large Amount of Stock - ResearchAndMarkets.com." 2020, May 13. https://www.businesswire.com/news/home/20200513005647/en/COVID-19s-Impact-Clothing-Industry---Retailers-Cancelling

[18] Aslaug Magnusdottir. "How Fashion Manufacturing Will Change After The Coronavirus." 2020, May 13. https://www.forbes.com/sites/aslaugmagnusdottir/2020/05/13/fashions-next-normal/?sh=24093a2978f3

[19] McKinsey & Company. "Perspectives for North America's fashion industry in a time of crisis." 2020, March 26. https://www.mckinsey.com/industries/retail/our-insights/perspectives-for-north-americas-fashion-industry-in-a-time-of-crisis

[20] McKinsey & Company. "The State of Fashion 2021: In search of promise in perilous times." 2020, December 1. https://www.mckinsey.com/industries/retail/our-insights/state-of-fashion

[21] statista. "Revenue of the leading apparel brands in the United States in 2019." 2020, November 23. https://www.statista.com/statistics/978396/leading-apparel-brands-by-revenue-us/

[22] Aaron Orendorff. "The State of the Ecommerce Fashion Industry: Statistics, Trends & Strategy." 2021, March 29. https://www.shopify.com/enterprise/ecommerce-fashion-industry

[23] Tommy John. "The State of Fashion: 100+ Fashion Industry Statistics (2021)." 2020, July 10. https://tommyjohn.com/blogs/news/fashion-industry-statistics

[24] FILIP ISAKOV. "15 Fashion Industry Statistics for Staying on Trend in 2021." 2021, April 9. https://moderngentlemen.net/fashion-industry-statistics/