Analysis of Fore and Aft Covid-19 Impact on Industry Data Based on Fama-French Five Factors

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Abstract: This paper examines performance of Fama-French five-factor model in US market before and after Covid-19 outbreak. The research purpose is to validate the efficiency of the model in the pandemic period, study if there're unexplained factors, and if Fama-French factors beta changes due to the pandemic impact. OLS method is applied to 49 Fama-French industry portfolios, and this paper finds that the efficiency of Fama-French five-factor model strengthened after the outbreak in all industries, while unexplained factor behavior increased. The pandemic brings significantly change to Fama-French factors beta of most of industries respectively, and has strong impact on portfolio performance and factor exposures.

1. Introduction

Identifying drivers of stock behaviors is the central issue of empirical finance, and several empirical researches present that the classical capital asset pricing model (CAPM) proposed by Sharpe (1964) and Linter (1965) fails empirical tests, which could imply most applications of CAPM to be invalid, argued by Fama and French (2004). Research presented by Banz (1981) and Stattman (1980) proves that the size effect and value effect cause a premium in CAPM model. Fama and French (1993) introduce the additional size and value factors: SMB, which refers to "Small (market capitalization) Minus Big" and HML, which refers to "High (book-to-market ratio) Minus Low" into the capital asset pricing model, to propose the Fama-French three-factor model. Furthermore, Fama and French (2015) add RMW and CMA factors to their three-factor model, extending it to a five-factor model. The profitability factor, RMW, refers to "Robust Minus Weak" operating profitability, while the investment factor, CMA, refers to "Conservative Minus Aggressive" investment style.

Most recent empirical evidences demonstrate that the Fama-French five-factor model behaves better than the three-factor model and the classical CAPM model, while the Fama-French factors reveal various behavior in explaining portfolio returns depending on time and markets. Fama and French (2012) explore common pattern of value premium which decrease with size in four developed markets (North America, Europe, Japan and Asia Pacific) and momentum returns in all above, except for Japan. Cakici et al. (2013) also notice value premium in emerging market, nevertheless the small and big value premium cannot be statically distinguished, which is the contrast of the result for developed markets. For the profitability and investment factor, an international research by Fama and French (2016) demonstrates that average stock returns for developed markets are positively correlated to profitability and negatively correlated to investment, except for Japan. For emerging market, Leite et al. (2018) find a clear size effect but few evidences of value, profitability and investment effect. Moreover, Fama and French (2015) demonstrate redundance of HML since RMW and CMA are introduced into the five-factor model, and the redundant effect also occurred in emerging market, reported by Leite et al. (2018). Also, the five-factor model remains stronger performance compared with CAPM and the three-factor model.

Due to its success in explaining average return in international markets, Fama-French model is widely applied in investigating regional or periodic market performances, including crisis periods (Gaunt, 2004; Czapkiewicz and Skalna, 2010; Lim et al., 2014; Yamani and Swanson, 2014). The recent recession caused by COVID-19 is gaining a lot of attentions, and several researches demonstrate the impact of the pandemic. McKibbin and Fernando (2020) perform a scenario

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analysis on the pandemic in its early stage, and conclude that the outbreak could significantly impact global economy in the short run, as it really did. Another research (Fernandes, 2020) also performs scenario analysis and summarized situation the global economy facing, pointing out that there're different conditions compared with past, such as combined demand and supply shock, limited economic tools and exhausted central banks. The research by Ozili (2020) study the spillover of the Covid-19 to several industries, and finding that the lockdown, monetary policy decisions and international travel restrictions severely affected economy while the imposed restriction on internal movement and more fiscal spending strengthened economy. The level of economic activities seems not to be significantly affected by increasing confirmed cases.

Various evidences prove that the Covid-19 pandemic causes serious recessions to the global economy, while adding a critical unpredicted factor to the market. There's a probability that properties of markets change, and the pattern of changing may vary due to the sector of economy.

The objective of this research is to validate factors of Fama-French five-factor model in the United State markets using industry data, to determine the efficiency of the model and factors fore and aft Covid-19 impact. The close study is an examination performed by Horváth and Wang (2020). They evaluate the performance of Fama-French five-factor model by tracking the R-squared value of the model, and find a substantial drop in R-squared during the spread of Covid-19. Only the market factor and profitability factor are found significant in their OLS model. However, Horváth and Wang's research is conducted at the early stage of the pandemic, which meaning their data to be insufficient, and they simply test the model by selecting 10 stocks in Fama and French's (2017) growth portfolio, which may cause biased conclusion. By analyzing industry data till the end of 2020, this research intends to solve these questions: Did the efficiency of Fama-French model really drop? Does the impact of Covid-19 bring statically significant external factor into industry markets? Moreover, how do coefficients of Fama-French factors react to the Covid-19 impact? By studying these questions, we intend to enhance understanding of markets in crises.

In section 2, we describe the method of research, including describing the empirical model, data and its source. In section 3, we summarize statistics of the Fama-French five-factor model in several industries as results. In section 4, we discuss the industrial economical nature inferred from statistics during the COVID-19 period. Section 5 concludes.

2. Method

2.1 The Empirical Model

The classical asset pricing model, proposed by Sharpe (1964) and Linter (1965), considers rate of expected return on an individual capital asset to be a linear combination of the risk-free interest rate and the market premium rate, as:

$R_i=R_f+\beta_i(R_m-R_f)$ i)

where R_i refers to the return rate of the asset, while R_f refers to the risk-free interest rate, R_m refers to the return rate of the market portfolio. β is the CAPM beta of the asset. To explain anomalies, Fama and French (1993, 2015) introduce additional factors into the asset pricing model, as:

$R_i=R_f+\beta_i(R_m-R_f)+s_iSMB+h_iHML+r_iRMW+c_iCMA$ ii)

where SMB refers to the excess returns of stocks of small caps over big caps, HML refers to the excess returns of stocks of high book-to-market ratio over low book-to-market ratio, RMW refers to the excess return of stocks with robust profitability over those with weak profitability, while CMA refers to excess return of firms that invest conservatively over those that invest aggressively. s_i, h_i, r_i and c_i are coefficients of these factors.

This paper uses the classical ordinary least squares (OLS) method to estimate the coefficients of the model regarding to each of the industries fore and aft Covid-19 impact. Adding a residual term and time into the model, the empirical model for regression as:

$R_{it}=R_{ft}+\beta_i(R_{mt}-R_{ft})+s_iSMB_t+h_iHML_t+r_iRMW_t+c_iCMA_t+\epsilon_{it}$ iii)

where ϵ_{it} refers to residuals.

2.2 Data

The data was adopted from Kenneth R. French's data library, including Fama-French 5 factors (2x3) daily data and daily data of 49 value-weighted industry portfolio returns from the beginning of March 2019 to the end of December 2020. Names of industries in the data are abbreviated, and are able to be consulted at French's data library. The paper follows the abbreviations of French in the below. According to the actual influence of Covid-19 on US, this paper study two periods connected by Feb 28th, which was set as the beginning of the outbreak. The former period includes 210 trading days and the latter period includes 213 trading days.

3. Summary of Statistics

3.1 Efficiency of the Model

The paper takes the ordinary R-squared value (goodness of fit) to be the indicator of the efficiency of the model applying on industries, regarding only one regress equation and similar sample size. Figure 1 displays the ordinary R-squared value of fitting before and after the Covid-19 outbreak.

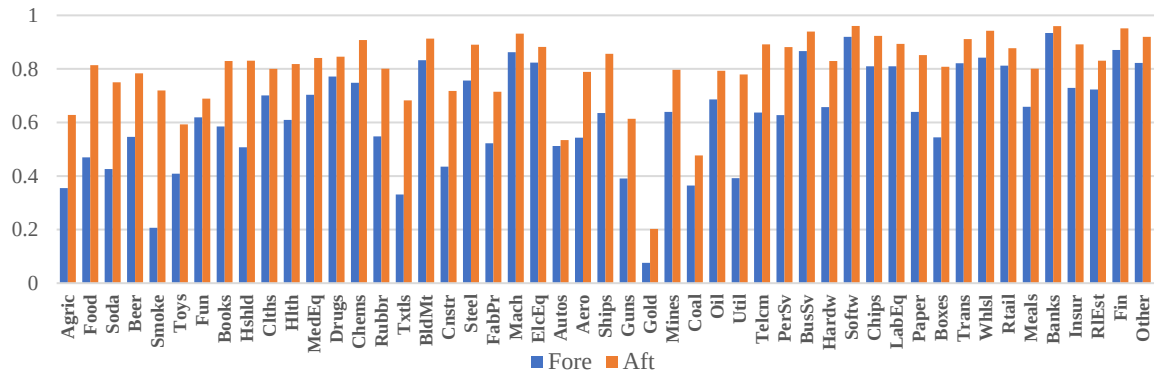

Fig.1 R-Squared Value Fore and Aft Covid-19 Outbreak.

In contrast to expectation, there are visible increases of R-squared in all of the 49 industries examined. The average industries R-squared is 0.63 in former period and 0.80 in latter period, increased by 0.17 after the outbreak, which infers strengthened efficiency of the five-factor model.

The paper implements Engle's ARCH-test (Engle, 1982), Lilliefors test (Lilliefors, 1967) and Durbin-Watson test (Durbin & Watson, 1950) with a significance level of 0.05 to each regression on industries to examine the nature of residuals.

Though the R-squared value suggests better efficiency of the model after the impact of Covid-19, Fama-French model fails Engle's ARCH-test which this paper use to determine residual heteroscedasticity when applying to most industries in the aft outbreak period. The ARCH-test is implemented with lags of 5, 10 and 15. Only 11 industries pass the ARCH-test in the latter period while 38 industries pass it in the former period. And, Chips is the only industry that fails ARCH-test in the former period and passes it in the latter period. The model behaves poorly when Lilliefors test which tests residuals normality implements, as more than half of industries fail the Lilliefors test in the latter period. However, most of industries pass the Durbin-Watson test, which is used to examine residual auto-correlation. Table 1 demonstrates the behavior of the model when implemented to each industry, examined by those tests.

Another indicator of anomaly is the intercepts appear in the regression. As the original equation of Fama-French model does not include an intercept, its appearance could mean unexplained factors in the model. The intercept for most industries is close to zero, and is not significantly obvious, except for Chems, BldMt and Coal before the outbreak. Interestingly, the intercept anomaly completely disappeared in the latter period.

Table 1 Residual Analysis Tests on Industries.

	ARCH		Lilliefors		DW			ARCH		Lilliefors		DW	
	Fore	Aft	Fore	Aft	Fore	Aft		Fore	Aft	Fore	Aft	Fore	Aft
Agric	Y	Y	N	N	Y	Y	*Guns*	Y	N	N	N	Y	Y
Food	Y	N	Y	Y	Y	N	*Gold*	N	N	Y	N	N	Y
Soda	Y	N	N	N	Y	Y	*Mines*	N	N	Y	Y	Y	Y
Beer	Y	N	Y	N	Y	N	*Coal*	Y	N	N	N	Y	N
Smoke	Y	Y	N	Y	Y	Y	*Oil*	Y	N	Y	N	Y	Y
Toys	Y	Y	N	Y	Y	Y	*Util*	N	N	N	N	N	Y
Fun	Y	N	Y	N	Y	N	*Telcm*	Y	N	Y	Y	Y	N
Books	Y	Y	N	N	Y	Y	*YerSv*	Y	N	N	N	Y	Y
Hshld	Y	N	Y	Y	Y	Y	*BusSv*	N	N	Y	N	Y	Y
Clths	Y	Y	Y	N	Y	Y	*Hardw*	Y	Y	N	N	Y	Y
Hlth	Y	N	Y	Y	Y	Y	*SoNtw*	Y	N	N	N	Y	Y
MedEq	N	N	Y	N	Y	Y	*ChiYs*	N	Y	N	Y	Y	Y
Drugs	Y	N	Y	Y	Y	N	*LabEq*	Y	N	Y	Y	Y	N
Chems	Y	Y	Y	Y	Y	Y	*YaYer*	Y	N	N	Y	Y	Y
Rubbr	N	N	N	N	Y	Y	*Boxes*	Y	N	Y	Y	N	Y
Txtls	Y	N	N	N	Y	N	*Trans*	N	N	Y	Y	N	Y
BldMt	N	Y	Y	N	Y	Y	*Whlsl*	Y	N	N	Y	Y	Y
Cnstr	N	N	Y	N	Y	Y	*Rtail*	Y	N	Y	Y	Y	Y
Steel	Y	N	Y	Y	Y	Y	*Meals*	Y	N	N	N	Y	Y
FabPr	Y	N	Y	N	Y	Y	*Banks*	Y	Y	N	N	Y	N
Mach	Y	Y	Y	Y	N	Y	*Insur*	Y	N	N	N	Y	Y
ElcEq	Y	N	N	N	Y	Y	*RlEst*	Y	N	Y	N	Y	Y
Autos	N	N	N	N	Y	Y	*Nin*	Y	N	N	N	Y	Y
Aero	Y	N	N	N	Y	Y	*Other*	Y	N	N	N	Y	Y
Ships	Y	N	N	N	Y	Y							

Notes: Tests are implemented to each industry at significance level of 5%. Y refers to “Passed” and N refers to “Failed”.

3.2 Estimator of Coefficients

Fig.2 Displays Coefficients of Fama-French Factors of Each Industry, Estimated by Ols Method, and We Summarize the Characteristics of Each Factors in Our Analysis Below.

Fore and aft the Covid-19 outbreak, the market risk premium is significant for nearly all of the 49 industry portfolios, with only one exception, which is Gold in the former period. Nevertheless, Gold then becomes significant after the impact of Covid-19. The total market risk premium coefficient remains nearly unchanged in the former and latter period, as the former period average beta of market risk premium is 0.94 and the latter is 0.96. In the contrast to the high degree of consistency of each industry’s market risk premium beta, the nature of industry beta of the other four factors is extremely complicated. Different industry return could be positively or negatively sensitive to Fama-French Factors excluding market risk premium or not. The industry factor coefficients and statistical significances may vary in any direction or not after the outbreak. Patterns of appearance of not existed statistical significances, vanish of existed significances, significances remaining the same and reversal of signals occur in different industries, and specific analysis of industries ought to be needed in practice. For most industry returns, the market risk premium plays the most influential role in both periods.

Also, the paper uses the absolute differences of factor beta of former and latter period as an indicator of how much is one industry’s Fama-French factors’ nature affected. Table 4 demonstrate the change with data that descending sorted by average absolute beta difference. Regarding to average absolute beta difference, the 10 industries that sensitivity to Fama-French factors changes most and least are listed in Table 2.

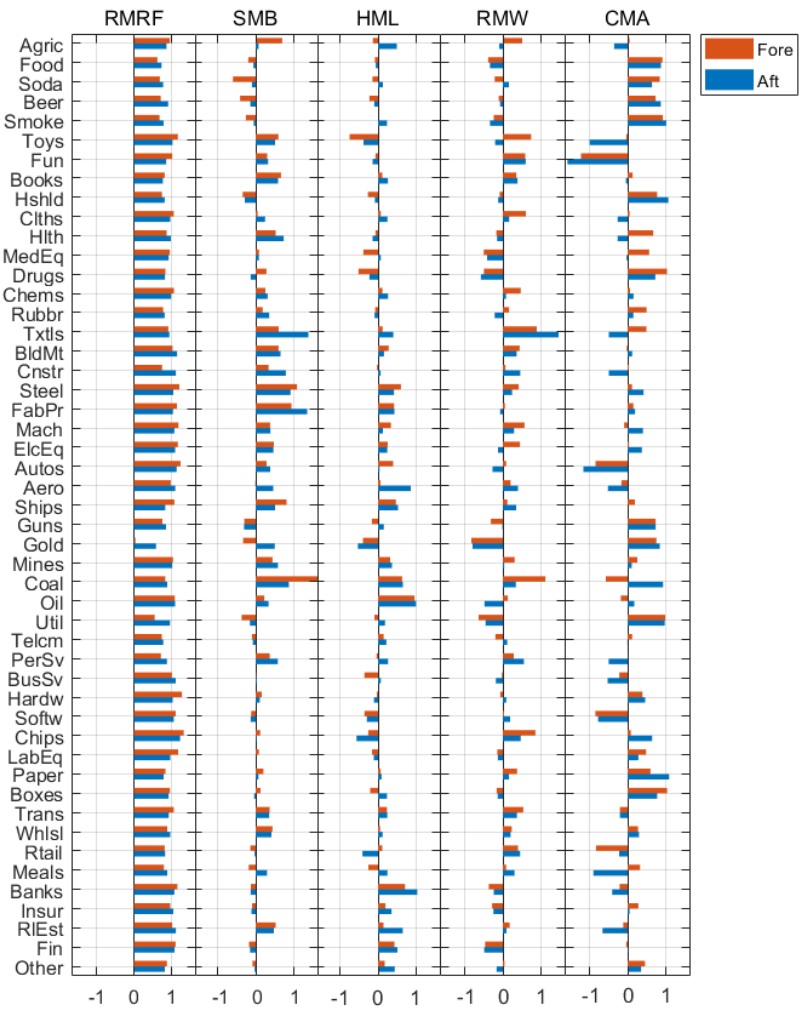

Fig.2 Estimators of Coefficients Fore and Aft Covid-19 Outbreak.

Table 2 Top 10 Industries with Most or Least Change of Factor Coefficients.

10 industries that coefficients change most		10 industries that coefficients change least
Coal, Txtls, Meals, Toys, Agric, Aero, Cnstr, Gold Chips, Persv.		Fin, Whlsl, Trans, Softw, Food, Books, Insur, BldMt, LabEq, Telcm.

4. Discussion

Although research by Horváth and Wang (2020) find a downward trend of R-squared in early 2020, this effect disappears in a longer observation period. In the contrast, there's an obvious increase in R-squared value in all of the industries this paper analyzed, suggesting that the ability of the Fama-French five-factors to explain industry returns is enhanced during the pandemic effect. This result may seem to be counterintuitive. However, according to Horváth and Wang's research, the Dotcom bubble has not caused their R-squared to drop rapidly, and the financial crisis in 2008 also brings a positive impact to R-squared of Fama-French growth portfolio model.

This means there's no obvious evidence that extreme events always have negative effects on efficiency of Fama-French models, and in the contrast, they may bring model efficiencies up naturally. The reason of the increase of R-squared is complicated, and shall be a valuable topic for research. One possible explanation is the strengthened systemic risk in extreme events. Though some characteristic stocks could stay relatively independent to the market trend, most stocks may be more sensitive to macroeconomy impact, and the independent noises will be somewhat covered by the whole market trend, leading to a higher goodness of fit of CAPM-based models.

Despite the goodness of fit of Fama-French five-factors model enhanced after the COVID-19 impact, the model behaves more poorly in residual analysis, compared with the former period.

Before the outbreak, the model fails ARCH-test in only 11 industries, and the number increases to 38 in the latter period. It also has bad performances in Lilliefors test both in the former and latter period, but better performances in Durbin-Watson test. Considering results of all the three tests, the paper has not found residual anomaly of Fama-French five-factor model in only a few of industries.

These residual analyses mainly examine if there are unexplained factors in actual data and they indicate that Fama-French five-factor model does not have enough explanatory power to explain the random walk of asset prices of most industry portfolios. For the industries where Fama-French model passes all the three residual analyses, we're able to believe that there's no need to add new factors into the model, and hypothetical tests based on classical linear model assumptions are appliable (see Kennedy, 2008). For the other industries, however, there's high possibility that unfound factors involve in determining these industry portfolio prices in the specific period. Though hypothesis tests and confidence intervals based on classical linear model assumptions become inaccurate and meaningless for these data, OLS estimators are still unbiased and keep a sort of robustness, according to Bohrnstedt's research (1971). As a result, t-statistics is still able to be used as an indicator of significance without an accurate p-value. Moreover, the focus of this paper is the more obvious feature of unexplained market factors that affect asset prices and the industry features of Fama-French factors in empirical analyses.

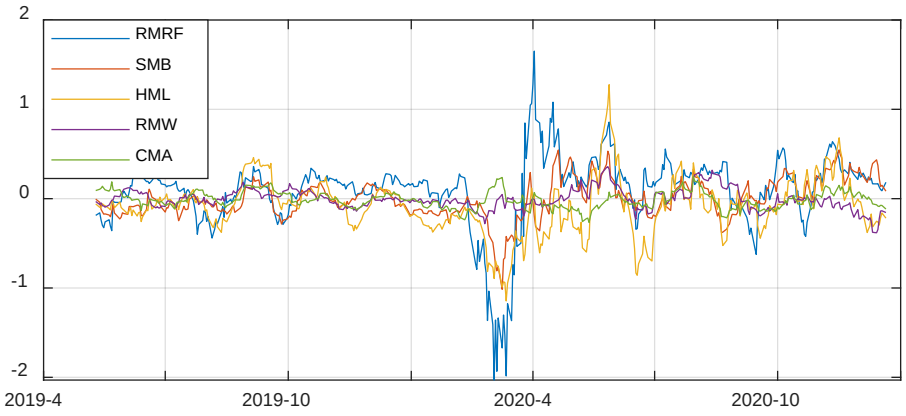

Fig.3 Rolling 15 Days Moving-Average of Fama-French Factors.

The most important Fama-French factor is the market risk premium, whose coefficients value is the largest among Fama-French factors in almost all industries. Estimators of market risk premium beta in all industries is positive, and it's always a large value with only one exception, which is the value in Gold in the former period, as described in the preceding section. As Fig.3 displays, the extreme event of Covid-19 outbreak caused substantial volatility of Fama-French factors, especially the market risk premium. Under the extreme market crash, the correlation of the return of the total market and industries that tended to be independent seems to be strengthened, while other industries tend to remain the same level of market beta. That means, independent industries could lose their low beta feature in an extreme, total recession, and cause an unpredicted, substantial loss.

The other four factors, including SMB, HML, RMW and CMA factors respectively play important roles in only parts of the 49 industries. Following the market premium risk factor, the SMB and HML factor drop in the early period of Covid-19 pandemic. The two relatively classical factors' performances then differentiate. The SMB factor has a weaker volatility and is positive mostly after Apr 2020, and the HML factor has more volatility and move up and down around zero. The new additional factors of Fama-French five-factor model, RMW and CMA, however, is more robust and less influenced by the pandemic. They move up and down around zero slightly both fore and aft the Covid-19 outbreak.

The SMB factor, standing for size effect, strongly affect asset pricing in most traditional industries. Only a few industries, which is Food, Soda, Beer, Smoke, Hshld, Guns, Gold and Util have significantly negative SMB beta, indicating a reversed size effect. However, most of the negative SMB beta before the pandemic weakened or even reverse after the outbreak. The SMB

beta seems to be larger in traditional industries, and very small in new, modern industries, as service industries and IT industries. What is notable is the SMB beta in Coal industry before the pandemic outbreak, which is the largest value, indicating very strong size effect.

Beta of the HML factor, standing for value effect, changes in most of industries. For agricultural, food, drink and tobacco industries, the HML factor beta which become positive during the pandemic from being small and negative. For most metal material and financial commodity industries, their HML beta remains the same at an obvious level. The value effect in financial industries, including Banks, Insur and RIEst which is always considered as alternative investment is obviously strengthened. Also, the value effect is significantly weakened in the medical sector.

The largest RMW betas, standing for the profit effect, appear in the Coal, Txtls, Chips and Toys industries before the Covid-19 outbreak. The RMW beta of Coal and Chips then drop while beta of Txtls increases to a very high level, and beta of Toys reverse to a low negative value. Several industries have negative RMW beta, and most of them belong to food, medical, commodity and finance sectors, which could be somewhat related to financial speculating. The profit effect in service and IT industries except for Chips is strengthened.

The CMA factor, standing for investment effect, has characteristic nature fore and aft the Covid-19 outbreak. It has high beta value as the market risk premium factor in lots of industries, and has more consistent industrial features. Daily goods industries such as Food, Soda, Beer, Smoke and Hshld have high CMA beta and remains after the outbreak, while Guns and Gold show the same characteristics. Hlth and MedEq, which used to show investment effect, have negative CMA beta after the outbreak. Among the industries with high negative CMA beta before the pandemic, Fun and Autos have larger negative CMA beta after the outbreak, while beta of Softw remain the same and beta of Rtail decrease. CMA beta of Txtls, Coal, Oil and Meals also obviously reverse after the outbreak, and CMA beta of Toys, Cnstr, Mach, ElcEq, PerSv, BusSv, Chips and RIEst increase to a notable positive or negative value from nearly zero.

Among all of the 49 industries, few industries could keep their Fama-French factor nature the same fore and aft the Covid-19 impact. Considering high market beta value of all industries (including Gold which used to have low market beta), no industry could detach itself from the influence of the pandemic and recession.

5. Conclusion

Although previous study found dropped rolling R-squared value of Fama-French model in the early stage of the Covid-19 pandemic, this research demonstrates a higher R-squared value of Fama-French five-factor model. In conclusion, the efficiency of Fama-French model to explain return of all industry portfolios increases in the pandemic.

Despite enhanced goodness of fit of Fama-French model, unexplained factors still exist in several industries both fore and aft the Covid-19 outbreak. In spite of this, the unexplained factor behaviors are more obvious and appears in more industries in the after-outbreak period. Very few industries show no evidence of unexplained factors after the outbreak, so the pandemic may strengthen industrial unexplained factors or brings new undiscovered factors into industries. Question that will these unexplained factors continue to exist after the pandemic's over is also a topic.

There is no doubt that Covid-19 outbreak triggered an earthquake in global financial market, causing substantial volatility of asset prices and several factors. The market risk premium, size and value factors dropped dramatically when the news of Covid-19 outbreak spread, while profit and investment factor keep stability. Though return of precious metals industry used to be uncorrelated or weakly correlated to market risk premium, its beta also rose to a high level in the pandemic, so no industry evaded the fall of asset prices among the total market. The pandemic also brings great change of nature of sensitivity of industries to the other Fama-French factors. Due to industry's own characteristics, each industry's exposure to Fama-French factors change differently, and reverse of beta of Fama-French factors also occurs. As a result, portfolios that constructed based on exposure

to size, value, profit and investment effect may lose their meaning and need to be reconstructed by immediate factors beta to keep original functions.

However, the Covid-19 pandemic is still an ongoing event. The accurate time of its end is still unknown, and there is still chance for the nature of industrial Fama-French factors to change. The behavior of Fama-French factors in the late-stage of Covid-19 pandemic and after-pandemic period is intriguing, and the further development of the situation deserves attention.

References

[1] Banz, R. W. (1981). The relationship between return and market value of common stocks. Journal of financial economics, 9(1), 3-18.

[2] Bohrnstedt, G. W., & Carter, T. M. (1971). Robustness in regression analysis. Sociological methodology, 3, 118-146.

[3] Cakici, N., Fabozzi, F. J., & Tan, S. (2013). Size, value, and momentum in emerging market stock returns. Emerging Markets Review, 16, 46-65.

[4] Czapkiewicz, A., & Skalna, I. (2010). The CAPM and Fama-French Models in Poland. Przegląd Statystyczny, 57(4), 128-141.

[5] Durbin, J., & Watson, G. S. (1950). Testing for serial correlation in least squares regression. Biometrika, 37(3/4), 409-428.

[6] Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. Econometrica: Journal of the econometric society, 987-1007.

[7] Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. Journal of financial economics, 33(1), 3-56.

[8] Fama, E. F., & French, K. R. (2004). The capital asset pricing model: Theory and evidence. Journal of economic perspectives, 18(3), 25-46.

[9] Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. Journal of financial economics, 116(1), 1-22.

[10] Fama, E. F., & French, K. R. (2017). International tests of a five-factor asset pricing model. Journal of financial Economics, 123(3), 441-463.

[11] Fernandes, N. (2020). Economic effects of coronavirus outbreak (COVID-19) on the world economy. Available at SSRN 3557504.

[12] Gaunt, C. (2004). Size and book to market effects and the Fama French three factor asset pricing model: evidence from the Australian stockmarket. Accounting & Finance, 44(1), 27-44.

[13] Horváth, D., & Wang, Y. L. (2020). The examination of Fama-French Model during the Covid-19. Finance Research Letters, 101848.

[14] Kennedy, P. (2008). A guide to econometrics. John Wiley & Sons.

[15] Leite, A. L., Klotzle, M. C., Pinto, A. C. F., & da Silva, A. F. (2018). Size, value, profitability, and investment: Evidence from emerging markets. Emerging Markets Review, 36, 45-59.

[16] Lilliefors, H. W. (1967). On the Kolmogorov-Smirnov test for normality with mean and variance unknown. Journal of the American statistical Association, 62(318), 399-402.

[17] Lim, D., Durand, R. B., & Yang, J. W. (2014). The microstructure of fear, the Fama–French factors and the global financial crisis of 2007 and 2008. Global Finance Journal, 25(3), 169-180.

[18] Lintner, J. (1965). The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. The Review of Economics and Statistics,47(1), 13-37.

[19] McKibbin, W., & Fernando, R. (2020). The global macroeconomic impacts of COVID-19: Seven scenarios. Asian Economic Papers, 1-55.

[20] Novy-Marx, R. (2013). The other side of value: The gross profitability premium. Journal of financial economics, 108(1), 1-28.

[21] Ozili, P. K., & Arun, T. (2020). Spillover of COVID-19: impact on the Global Economy. Available at SSRN 3562570.

[22] Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. The journal of finance, 19(3), 425-442.

[23] Stattman, D. (1980). Book values and stock returns. The Chicago MBA: A journal of selected papers, 4(1), 25-45.

[24] Yamani, E. A., & Swanson, P. E. (2014). Financial crises and the global value premium: Revisiting Fama and French. Journal of International Financial Markets, Institutions and Money, 33, 115-136.