Eximia journal

Eximia Journal

(ISSN 2784-0735)

Vol. 5

2022

Eximia Journal
Vol. 5, 643-646, July, 2022
ISSN: 2784-0735
www.eximiajournal.com

Factor Risk Premia During The COVID-19 Pandemic: Evidence from Chinese Stock Markets

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Abstract. This study investigates the impact of new COVID-19 cases on the factor risk premia in Chinese stock markets. Fama-Macbeth's two-pass procedure is applied to estimate the time-varying risk premia associated with Fama and French's (2015) five factors. I assess the impact of new COVID-19 cases on factor risk premia by bivariate vector autoregressive models. Empirical results show that new COVID-19 cases negatively affect the market risk premium but significantly increase the size premium in Chinese stock markets. These findings shed light on the influence of COVID-19 on the factor structure and risk premia in equity markets.

Keywords. COVID-19 pandemic, stock markets, factor risk premia, asset pricing

1. The first section in your paper

The financial influence of the COVID-19 pandemic has received much attention from the existing literature (Ding, Levine, Lin & Xie, 2021; Altig et al., 2020; Goldstein, Koijen & Mueller, 2021; Albulescu, 2021; Zhang, Hu & Ji, 2020; Phan & Narayan, 2020; Zohra, Abbassia & Zohra, 2022). Previous studies generally conclude that COVID-19 has an adverse impact on global equity markets by decreasing stock prices and increasing price volatility. As a persistent health crisis, COVID-19 affects not only the short-term performance of equity markets but also the investment opportunity and risk preference of investors. Thus, it is of interest to investigate the factor risk premia of common stocks. However, prior studies pay little attention to this issue.

This study examines the interaction between the factor risk premia in Chinese stock markets and the growth of confirmed COVID-19 cases. Fama-Macbeth's two-pass procedure is applied to estimate the time-varying risk premia associated with Fama and French's (2015) five factors (Fama & MacBeth, 1973; Fama & French, 2015). Furthermore, I assess the impact of new COVID-19 cases on factor risk premia by bivariate vector autoregressive (VAR) models. Empirical results indicate that the increase in confirmed COVID-19 cases decreases the market risk premium but increases the size premium. The value, profitability, and investment premia are hardly affected by new COVID-19 cases. These findings shed light on the influence of COVID-19 on the factor structure in equity markets.

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2. Methodology and Empirical Results

Given N assets, the factor risk premia can be estimated using Fama-Macbeth's two-pass procedure. In the first pass, the risk exposures, β_t^i, are computed by multiple time-series regressions,

$$R_t^i - r_t^f = \alpha_t^i + \beta_t^{1i} f_t^1 + \cdots + \beta_t^{Ki} f_t^K + \varepsilon_t^i, \quad (1)$$

where R_t^i is the return on asset i for day t; r_t^f is the risk-free rate; $f_t^1, f_t^2, \ldots, f_t^K$ are K common factors and $\beta_t^{1i}, \beta_t^{2i}, \ldots, \beta_t^{Ki}$ the associated risk exposures; α_t^i denote the pricing errors; and ε_t^i is the disturbance term. I estimate the risk exposures in a rolling window of 250 trading days (around one calendar year). In the second pass, the factor risk premia are derived with the cross-sectional regressions,

$$R_t^i - r_t^f = b_t + \lambda_t^1 \beta_t^{1i} + \cdots + \lambda_t^K \beta_t^{Ki} + e_t^i, \quad (2)$$

where $\lambda_t^1, \lambda_t^2, \ldots, \lambda_t^K$ are the factor risk premia for day t; b_t and e_t^i denote the constant and disturbance terms.

I assess the impact of COVID-19 confirmed cases on factor risk premia by the vector autoregressive (VAR) model. For a given week t, n_t denotes the number of new COVID-19 cases; Y_t is the cumulative number of COVID-19 cases. Then, the growth rate of confirmed cases is computed as $g_t = \frac{n_t}{Y_t}$. The weekly averages of factor risk premia are calculated as $\Psi_t^k = \frac{\sum_{d \in t} \lambda_d^k}{D_t}$, where D_t is the number of daily observations in week t. I use a bivariate VAR model to investigate the interaction between Ψ_t^k and g_t,

$$\begin{pmatrix} g_t \\ \Psi_t^k \end{pmatrix} = \begin{pmatrix} \mathrm{a}^k \\ \mathrm{b}^k \end{pmatrix} + \sum_{v=1}^{V} \begin{pmatrix} c_{11}^{k,v} & c_{12}^{k,v} \\ c_{21}^{k,v} & c_{22}^{k,v} \end{pmatrix} \begin{pmatrix} g_{t-v} \\ \Psi_{t-v}^k \end{pmatrix} + \xi_t^k,$$

where a^k, b^k, $c_{11}^{k,v}$, $c_{12}^{k,v}$, $c_{21}^{k,v}$ and $c_{22}^{k,v}$ are constant parameters; ξ_t^k is a vector of the disturbance terms.

The empirical study is conducted with data from Chinese stock markets. I collect the daily returns on all A-shares listed on the Shanghai Stock Exchange. The base rates on 1-year fixed deposits measure the risk-free rates. The five factors proposed by Fama and French (2015) are used as the common factors in this study. The data are downloaded from the CSMAR database. The sample spans from July 1, 2018, to November 18, 2022. The statistical description of the main variables is reported in Table 1.

Table 1. Description of Main Variables.

	Obs.	Mean	S.D.
R_t^i (%)	1,022,236	0.090	2.800
r_t^f (%)	901	0.004	0.000
$mktrf_t$ (%)	901	0.050	1.230
smb_t (%)	901	0.034	0.788
hml_t (%)	901	-0.007	0.686

Eximia Journal
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www.eximiajournal.com

rmw_t (%)	901	0.010	0.524
cma_t (%)	901	-0.008	0.509

The estimation of bivariate VAR models is presented in Table 2. The number of lags, V, is specified with the AIC criterion for each factor. Due to space limitations, I only report the estimators of $c_{21}^{k,v}$ that reflect the impact of new COVID-19 cases on factor risk premia. It is shown that $c_{21}^{mktrf,1}$ is negatively significant around -0.028. Thus, the increases in COVID-19 confirmed cases negatively affect the market risk premium in Chinese stock markets. This finding is consistent with the observed bad performance of Chinese stock markets after the outbreak of COVID-19. Besides, I find a positively significant $c_{21}^{smb,3}$ about 0.001. This finding implies that increased COVID-19 cases have a positive and lagged effect on the size premium. One possible explanation is that COVID-19 has a more profound impact on small-sized firms. Thus, they tend to be more under-priced when the number of confirmed cases substantially increases. Finally, the impact of new COVID-19 cases on Ψ_t^{hml}, Ψ_t^{rmw} and Ψ_t^{cma} are all insignificant.

Table 2. Estimation of Bivariate VAR Models

	$c_{21}^{k,1}$	$c_{21}^{k,2}$	$c_{21}^{k,3}$
Ψ_t^{mktrf}	-0.028**		
	(-2.26)		
Ψ_t^{smb}	-0.000	0.000	0.001**
	(-0.12)	(0.78)	(2.38)
Ψ_t^{hml}	-0.000	0.000	-0.003
	(-0.87)	(0.08)	(-0.74)
Ψ_t^{rmw}	0.009		
	(0.16)		
Ψ_t^{cma}	-0.000		
	(-0.46)		

Note: This table presents the estimation of bivariate VAR models for factor risk premia and growth rates of confirmed COVID-19 cases. *, **, and *** denote significance at the 10%, 5%, and 1% levels.

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3. Conclusion

This study examines the impact of the confirmed cases of COVID-19 on the factor risk premia in Chinese stock markets. The Fama-Macbeth two-pass regressions are applied to estimate the factor risk premia associated with Fama and French's (2015) common factors. Bivariate VAR models are specified for investigating the interaction between new COVID-19 cases and factor risk premia. The empirical results show that the increases in the confirmed cases of COVID-19 negatively affect the market risk premium in Chinese stock markets but positively affect the size premium. These findings shed light on understanding the influence of COVID-19 on the factor structure and risk premia in equity markets.

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