

Study on the Impact of Stock Market Performance on REITs Market in China

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Keywords: Stock market, REITs market, impact

Abstract: China's real estate trust business started in 2002, and has experienced four stages: germination, stagnation, pilot operation and practical development. In the financial market, the stock market will directly reflect the macroeconomic factors represented by monetary policy, external financial market, interest rate and exchange rate, and have an impact on REITs through the secondary market. With the development of China's domestic REITs market, to evaluate the risk impact of the REITs market more accurately and form a stable risk early warning and prevention mechanism is quite important. This paper expounds the basic connotation and main characteristics of real estate investment trust, through the TVP-VAR model, analysis of the mainland REITs influenced by the stock market, it is concluded that the domestic stock market responds directly to the domestic and international monetary policy, and through the stock market to REITs market, and the effect time is mainly short-term, but the impact effect is more obvious.

1. Basic connotations and main characteristics of REITs

1.1 Basic connotation of the REITs

REITs refers to a standardized financial product that is publicly traded in the stock exchange and transforms real estate assets or interests with sustained and stable returns into highly liquid listed securities through securitization. REITs gain profits by raising money from a large number of investors to invest in real estate assets. Compared with stocks and bonds, REITs are characterized by relatively medium risk and moderate yield.

1.2 Main characteristics of the REITs

REITs is rather new compared with the traditional securitization trust. Its main features are as follows: First, rich and diversified investment forms. Second, managed by professionals familiar with real estate management and operation. Third, the liquidity is strong and can be realized in the open market. Fourth, the system design fully embodies the concept of investors' interest protection, more suitable for small and medium-sized investors. Fifth, a higher dividend payment and dividend ratio. Sixth, to enjoy more tax breaks. Seventh, the active management of risks, such as through legislation, guidelines and other forms of clear establishment and regulatory requirements.

Chang M S et al.(2011)has conducted full practical research and data collation during the

research activities, and has carried out portfolio construction activities. He believes that REITs products are very critical components in the portfolio field. The existence of such factors can disperse risks and reduce their uncertainty as much as possible^[1]; Deng X et al.(2018)specially analyzed the cost problem during the issuance of REITs and the profound impact on the return rate of real estate trust funds after the official listing. They believed that in the actual circulation process, once the cost limit of the issuance continues to increase, it will lead to the emergence of non-public transactions. After the listing, the liquidity of REITs will naturally decrease, and the return rate will also decrease. On the contrary, it will increase the liquidity of REITs, which may increase the return on capital^[2].Peterson J D et al. (1997) used the Fama-French three-factor model to fit and verify the REITs and the stock market returns, and determined the profound impact of different factors such as value, scale and market on the REITs market returns through validation analysis^[3]; Swanson Z et al. (2002) mainly selected the data from 1989 to 1998 during the research process. Through the collection and collation of the data and the construction of the empirical analysis model, it was explained that compared with the term structure of interest rates and related credit risks, the changes in the stock market have a more obvious impact on the yield of REITs. On the basis of the research conclusions obtained by previous scholars, other researchers have conducted research on samples from different regions, and the conclusions are also highly consistent with the above conclusions^[4]. Chiang Y H et al.(2008) focused on the REITs yield of the United States, Singapore and other countries for analysis. The final conclusion is that the performance difference of this correlation is quite obvious due to different historical periods and different geographical advantage^[5];Tsai M S et al.(2010) Some researchers specially selected the Asian market as the specific analysis object, interpreted its relevance, and reached the same conclusion^[6];Larson S J (2005) and Chen Y (2007) clearly pointed out that there is the same direction change between the real estate investment trust period and the stock market, and the stock index changes faster^[7].

2. Theoretical basis of the TVP-VAR model

VAR is primarily used to analyze the dynamic effects of random perturbation terms on variables and can be used to predict interconnected time-series systems. In order to avoid the structured model, the VAR method constructs the model by taking each endogenous variable in the system as the lag value of all the endogenous variables in the system. The VAR (P) model can be expressed in the following form:

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + Bx_t + \varepsilon_t \quad (1)$$

Is an k-dimensional endogenous variable, x_t is an d-dimensional exogenous variable.and B are the coefficient matrix to be estimated. ε_t is the disturbance terms, which can be correlated with each other, but not with their own lag period and not with the variables on the right side of the equation.

$$\begin{pmatrix} y_{1t} \\ y_{2t} \\ \vdots \\ y_{kt} \end{pmatrix} = A_1 \begin{pmatrix} y_{1t-1} \\ y_{2t-1} \\ \vdots \\ y_{kt-1} \end{pmatrix} + A_2 \begin{pmatrix} y_{1t-2} \\ y_{2t-2} \\ \vdots \\ y_{kt-2} \end{pmatrix} + \dots + Bx_t + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \vdots \\ \varepsilon_{kt} \end{pmatrix} \quad (2)$$

Since the traditional VAR model reflects the impact process between the variables with invariant parameters, an accurate description of the nonlinear process cannot be achieved. If the VAR model continues to be used, it may not be able to measure the time-varying parameters, which will cause some errors to the measurement results. Therefore, based on the analysis of the traditional VAR model, this paper then introduces the time-varying parameter VAR model to analyze whether there is a time-varying phenomenon in the sample period. Since there are three variables in this paper, a time-variable VAR model is built on this basis. The following formula is used to represent the

TVP-VAR model:

$$y_t = c_t + B_{1t}y_{t-1} + \dots + B_{st}y_{t-s} + e_t \quad e_t \sim N(0, \Omega_t) \quad (3)$$

$t = s + 1, \dots, n, y_t$ is the observation variable of a $k \times 1$ dimension, B_{1t}, \dots, B_{st} is time-varying coefficient matrix of $k \times k$ size, Ω_t is the time-varying covariance matrix of size. From $\Omega_t = A_t^{-1} \sum_t \sum_t A_t^{t-1}$, a putative recursive recognition can be concluded. The stacked row vector is defined as B_{1t}, \dots, B_{st} , and the free lower triangle element, the stacked row vector is defined as $a_t = (a_{1t}, \dots, a_{qt})$. When $h_{it} = \log \sigma_{it}^2$, $h_{it} = (h_{1t}, \dots, h_{kt})$. Then this time-varying parameter follows the basic law of the random walk process:

$$\begin{aligned} \beta_{t+1} &= \beta_t + \mu_{\beta_t} \\ a_{t+1} &= a_t + \mu_{a_t} \\ h_{t+1} &= h_t + \mu_{h_t} \end{aligned} \begin{pmatrix} \varepsilon_t \\ \mu_{\beta_t} \\ \mu_{a_t} \\ \mu_{h_t} \end{pmatrix} \sim N \left(0, \begin{pmatrix} I & 0 & 0 & 0 \\ 0 & \Sigma \beta & 0 & 0 \\ 0 & 0 & \Sigma a & 0 \\ 0 & 0 & 0 & \Sigma h \end{pmatrix} \right) \quad (4)$$

$$= A_t^{-1} \sum_t \varepsilon_t, \sum_t a \text{ and } \sum_t h \text{ are Diagonal matrix, } \beta_{t+1} \sim N(\mu_{\beta_0}, \sum \beta_0), a_{s+1} \sim N(\mu_{a_0}, \sum a_0), h_{s+1} \sim N(\mu_{h_0}, \sum h_0)$$

3. Empirical research and analysis of the mainland REITs market

With 9 REITs products issued by the mainland as the research objects (AVIC Shougang Green Energy, Boshi Shekou Production Park, Zheshang Securities Shanghai-Hangzhou-Ningbo Expressway, Zhongjin Prolos Storage and Logistics, Fuguo Capital Water, Soochow Suzhou Industrial Park Industrial Park, Ping An Guangzhou Guanghe, Hua'an Zhangjiang Everbright Park, Red Earth Innovation Salt Port), taking the study interval from June 21, 2021 to November 1, 2022, according to Dr. Suilan of Peking University, the average price of REITs was calculated using a weighted average method, the mainland comprehensive REITs index was constructed; At the same time, the CSI 300 index, CSI 1000 index and real estate index are selected to represent the mainland stock market, the Hang Seng Composite Large Stock Index, Hang Seng Composite Small Stock Index, Hang Seng Real Estate Index are selected to represent the Hong Kong stock market, then study the impact of the mainland and Hong Kong stock market performance on the REITs market.

3.1 Calculation of the lag coefficient

The choice of lag order will affect the overall dynamic characteristics of the model. By analyzing the reference and data characteristics of existing documents and passing the test of relevant methods, the lag order of different REITs in the mainland and the stock market (see Table 1).

Table 1: Mainland REITs

Stock ground	Name	Lag
Mainland	Mainland comprehensive REITs	1
Hong Kong	Mainland comprehensive REITs	1

The correlation between mainland stock index and Hong Kong stock index and mainland REITs is shown in Table 2 and 3.

Table 2: Lag of Mainland stocks-Mainland REITs

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2062.978	22.47768	4.693581	12.89769	13.13160	12.99107
1	-2074.393	NA*	4.562175*	12.86931*	12.91609*	12.88798*
2	-2055.338	14.85290	4.943199	12.94946	13.37050	13.11754
3	-2045.072	19.70575	5.122452	12.98497	13.59313	13.22774
4	-2039.141	11.23885	5.453140	13.04731	13.84261	13.36478
5	-2027.389	21.97570	5.600416	13.07361	14.05604	13.46579

Table 3: Lag of Hong Kong stocks-Mainland REITs

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1592.412	NA	3.916046	9.878714	9.913800	9.892720
1	-1546.307	91.06801	3.112213	9.648962	9.789308*	9.704986*
2	-1532.935	26.16537	3.029133	9.621887	9.867493	9.719930
3	-1523.705	17.88879	3.024937*	9.620462*	9.971328	9.760524
4	-1521.055	5.086169	3.146473	9.659783	10.11591	9.841863
5	-1511.591	17.99049	3.137799	9.656909	10.21829	9.881008

3.2 Time-varying parameters of the stock market of the stock index and the mainland REITs

The contents in Tables 2 to Table 5 are the mean, standard deviation, 95% confidence interval, Geweke probability and null factor of the posterior distribution of the TVP-SV-VAR model parameters. Geweke probability and the null factor are the indicators used to determine whether the MCMC simulation process converges. As can be seen from the Geweke index, the Geweke of the nine models is at the 5% significance level (the cut-off value is 1.96). The MCMC simulation results converge to the posterior distribution, and the model sampling is effective on the whole.

3.2.1 The parameter estimates of the mainland stock index, the Hong Kong stock index and the mainland REITs are shown in Table 4-4 and Table 4-5, respectively.

Table 4: Parameter estimation results of mainland stock index and mainland REITs

Parameter	Mean	Stdev	95%U	95%L	Geweke	Inef.
sb1	0.0036	0.0009	0.0024	0.0059	0.002	217.87
sb2	0.0034	0.0008	0.0023	0.0056	0.068	175.24
sa1	0.0241	0.0048	0.016	0.0344	0.001	205.25
sa2	0.0265	0.0058	0.0176	0.0404	0.61	214.84
sh1	0.2401	0.0189	0.1991	0.2769	0.653	43.49
sh2	0.3028	0.0234	0.2557	0.3475	0.001	59

Table 5: Results of parameter estimation of Hong Kong Stock Index and mainland REITs

Parameter	Mean	Stdev	95%U	95%L	Geweke	Inef.
sb1	0.0041	0.0013	0.0025	0.0075	0.983	269.43
sb2	0.0042	0.001	0.0027	0.0063	0.666	200.57
sa1	0.0304	0.0116	0.0112	0.0477	0	325.5
sa2	0.0185	0.0036	0.0113	0.0259	0.901	234.24
sh1	0.2317	0.0194	0.1943	0.2682	0.912	52.71
sh2	0.2277	0.0216	0.1862	0.2681	0.268	111.52

3.2.2 The parameters and sampling process of mainland stock index, Hong Kong stock index and mainland REIT are shown in Figure 1 and Figure 2, respectively.

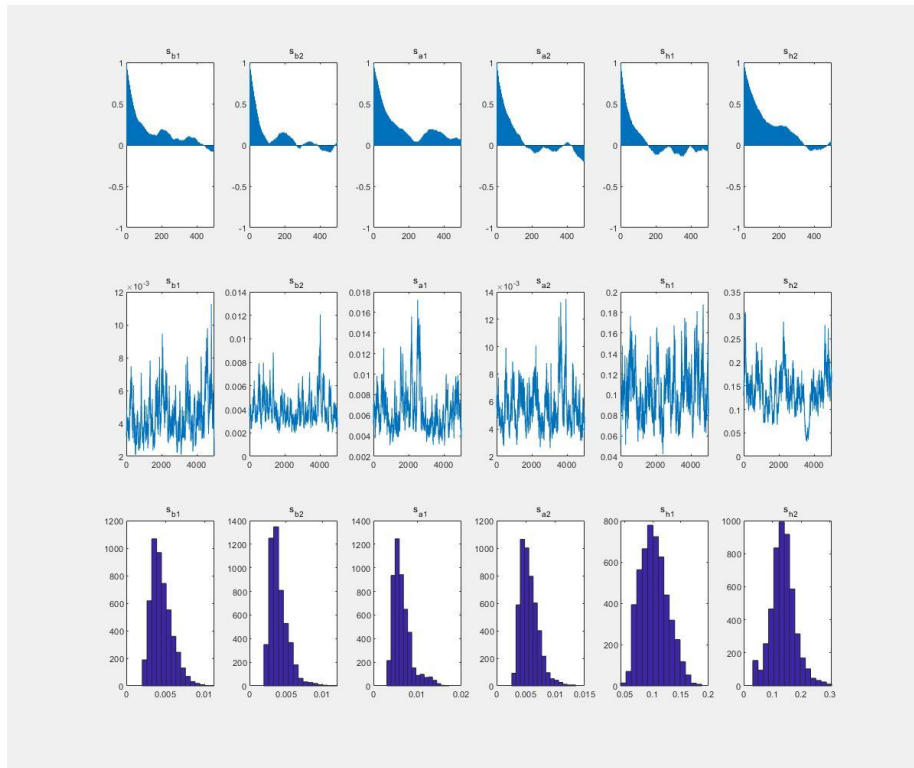


Figure 1: Parameters and sampling process of mainland stock index and mainland REITs

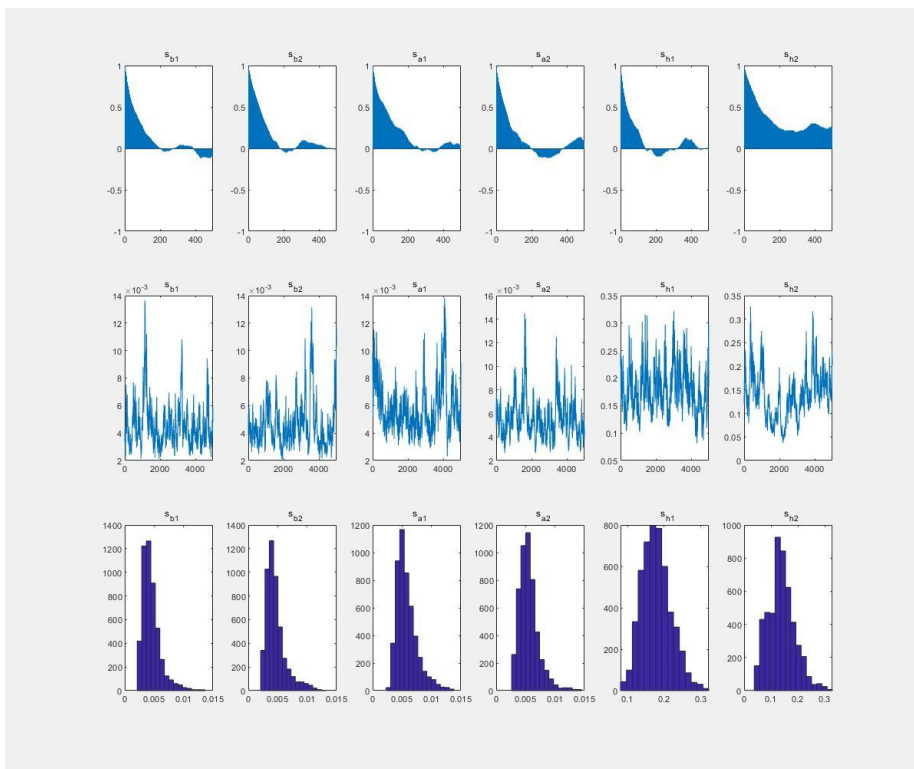


Figure 2: Parameters and sampling process of Hong Kong Stock index and mainland REITs

3.3 Time-varying characteristic analysis of the parameters

In the TVP-SV-VAR model, the parameters change with time, which is reflected in the figure as a curve with time. In the figure, the mainland and Hong Kong stock indexes each have a significant impact on REITs. The time-varying parameter characteristics of mainland stock index, Hong Kong stock index and mainland REITs are shown in Figure 3 and Figure 4 respectively.

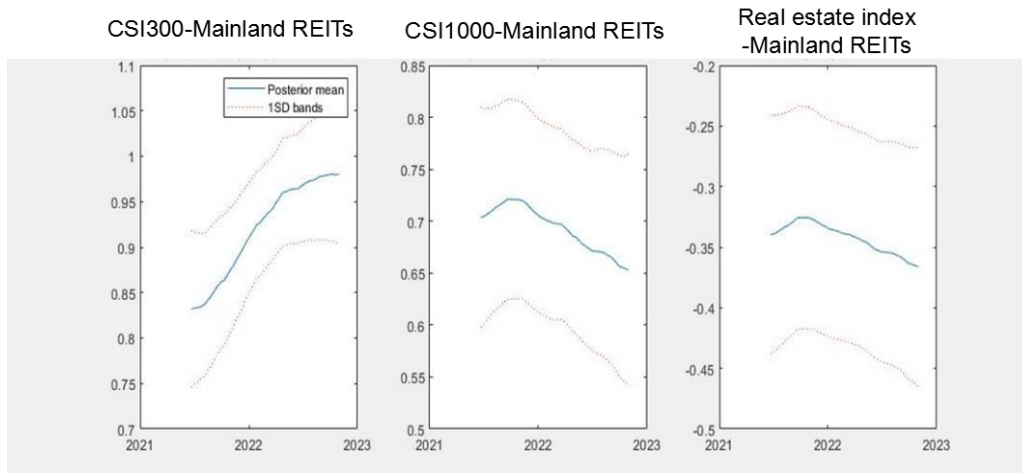


Figure 3: Characteristics chart of time-variable parameters of mainland stock index and mainland REITs

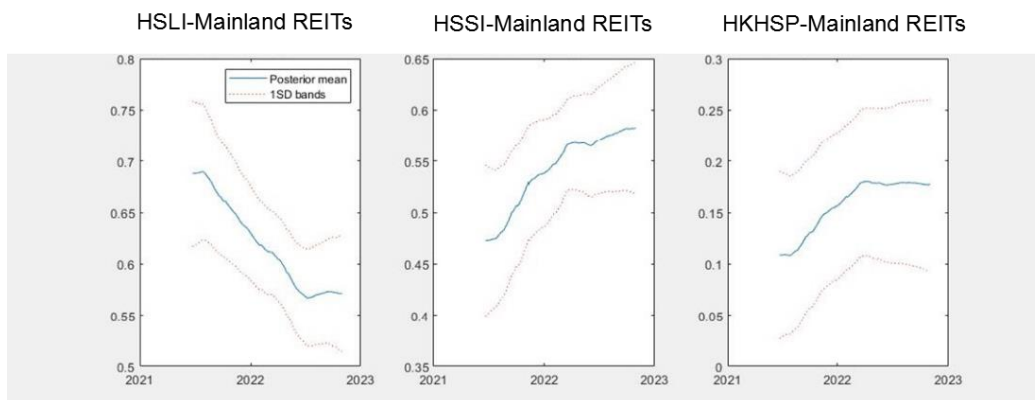


Figure 4: Characteristics diagram of time-varying parameters of Hong Kong stock index and mainland REITs

The common features can be seen in the TVP-SV-VAR model, that is, the change curve of parameters over time, each group of REITs corresponding to the three stock indexes in mainland and Hong Kong have a significant impact on REITs.

4. The time-varying pulse relationship between the stock index and the mainland REITs under the multiple advance period

On the basis of the analysis of the time-varying parameters, the interaction between the stock index and the mainland REITs is analyzed. Figure 5 and 6, time-varying characteristic pulse diagram of the stock index and the mainland REITs under the multiple advance period, reflecting the lagging influence of the stock index on the mainland REITs.

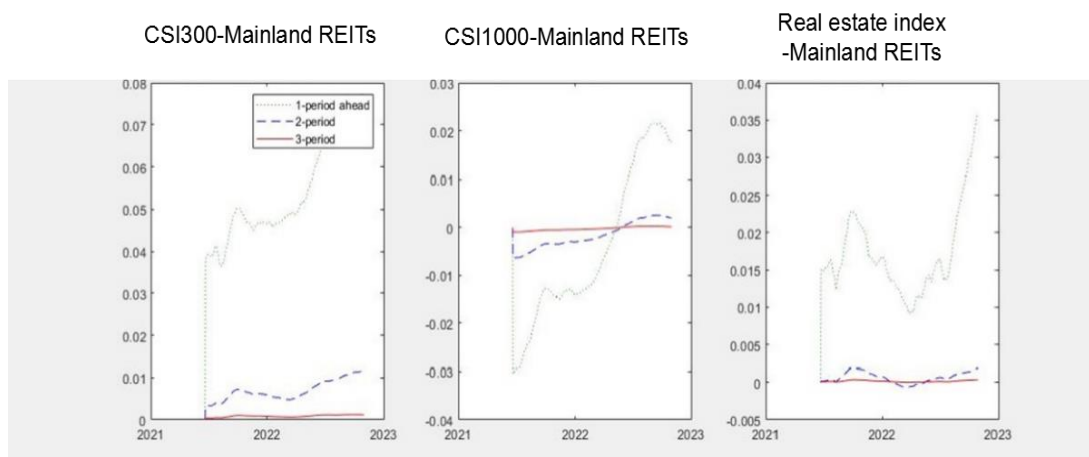


Figure 5: Time-varying characteristics chart of mainland stock index and mainland REITs pulse response

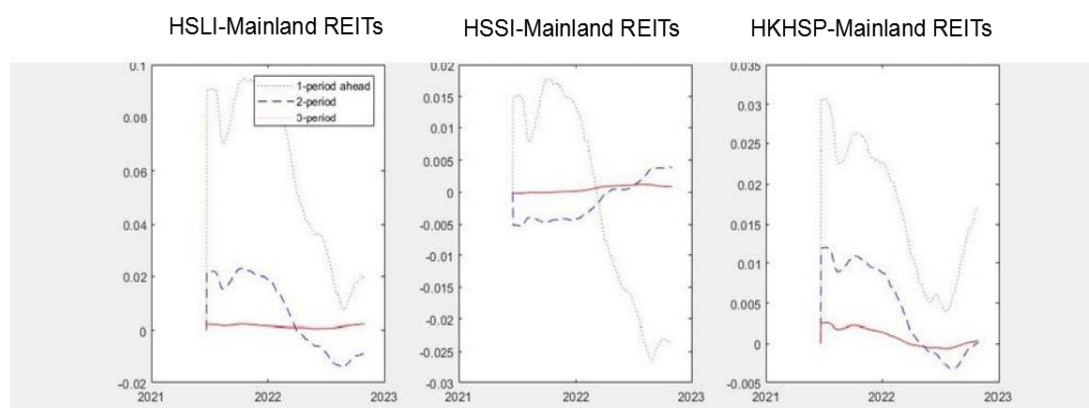


Figure 6: Time-varying characteristics of REITs pulse response of Hong Kong stock index and mainland REITs

On the basis of the analysis of the time-varying parameters, the interaction between the stock index and the mainland REITs is analyzed as follows: as can be seen from the time-varying feature chart, the short-term impact of stock index on mainland REITs is relatively significant, which becomes insignificant after more than a year, so its direct impact on long-term REITs in mainland is weak.

5. Conclusion

The volatility of the securities in the capital market of real estate investment trust yields will have a significant impact, according to the above TVP-VAR model research of mainland REITs affected by the stock market, it can be concluded that the influence of the short term is rapid, and the influence of the REITs market factors are from the economic cycle risk, interest rate risk, inflation risk, price risk, and imperfect regulations, insufficient tax preferential policies and low income distribution ratio. With the development of China's domestic REITs market and the integration into the international financial market through Hong Kong REITs, risk management should meet the requirements of international standards. How to strengthen risk management, improve the level of risk management, prevent systemic risks and conduct risk early warning has become the top priority in the development of the domestic REITs market.

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