

Fund Valuation Analysis of Regional Industrial Economies

—Empirical Analysis Based on 3660 Samples From 15 Funds

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ABSTRACT

With the development of China's economy, a regional pattern has gradually formed in which the eastern region takes the lead, the western region actively promotes, and the central region speeds up its development. However, there is still a great imbalance in regional development and the regional economic gap is obvious. Based on this, according to the grade of R1- R5, select scattered in the east, middle and west areas, a total of 15 open-end fund market, with its 2021 annual unit net asset value as the research sample. By using the H-P filter method, OLS regression and Tobit model, the changing trend of the net asset value per unit is analyzed, and the following research conclusions were drawn: ①From the total assets and net profits of the enterprises corresponding to fund holdings, there is a decreasing trend in the eastern, central and western regions, besides the number of related fund companies is also decreasing. ②The analysis for fund classification reveals that the model fits relatively better for funds in the R2-R4 category. ③The fund stability and the fit of the fund prediction model are higher in the central and eastern regions than in the western region.

Keywords: Regional Development, Industrial Economy, Fund Valuation, H-P Filter Method, Tobit Model

1. INTRODUCTION

China's economy continues to develop rapidly, but the problem of uneven regional economic development has not yet been effectively addressed, which is particularly evident in the fund market. Nowadays, the development and the perfection of the fund market have become an important symbol to measure the maturity of a country's economic operation. In this view, it is important to empirically analyze NAV(Net Asset Value) in regional industrial economies, which is conducive to promoting the synergistic development of China's funds and regional economies to form an efficient, interactive, highly orderly development model.

This paper adopts the R1-R5 fund risk rating, selects 15 open-end market funds scattered in the three economic regions of eastern, central and western China, and takes the unit net asset value data of 2021 as the research sample. The innovation of this paper is that the long-term trend data is used as the explained variable after the random fluctuation is decomposed by H-P Filter Method.

Through the statistical analysis of various fund types in the East, West and Central regions, we focus on the regional radiation of geographical economies and use this to study the fluctuation and geographical heterogeneity of the net unit value of funds and make net value forecasts. This enriches the research results on the decisive influence of geographical factors on the change of the net unit value of funds. In addition, this paper uses ArcGIS technology to display the geographical distribution pattern of funds and uses Symbology tools to visualize the data and conduct radiation analysis of regional economies, dissecting the correlation between fund development and geography, with a view to providing support for the optimal layout and strategic direction of China's fund industry.

2. REVIEW OF THE LITERATURE

2.1. Industrial and Regional Industrial Economy

Research on the industrial economy has been a

popular topic for many scholars. Xiaomeng Jia mainly analyzed the characteristics and significance of the integration of industrial economy and new media, studied the integration development model [1]. Ding Li li and Lei Liang et al. used the extended Malmquist index method to study the efficiency performance of the circular industrial economy (ICE) and its dynamic evolution, and also argued the internal structure of the industrial circular economy system [2]. Chulan Chen proposed an evaluation model for the effectiveness of the spatial evolution layout planning method of the industrial economy of small coastal characteristic towns based on the output-driven hypothesis model [3].

Huan Huang with Fan Wang used the entropy method, coupled coordination model, spatial econometric model to study the CCD of Regional economic growth, Regional economic growth and its influencing factors [4]. Du ErLe and Ji Meng established a model of influencing factors of economic benefits in high-tech development zones based on Data Envelopment Analysis (DEA) for Machine Learning (ML) and Malmquist index measures algorithm to study the changes of the regional economy [5]. Decheng Fan and Kairan Liu investigated the impact of artificial intelligence (AI) on regional economic development based on the generalized method of moments and fixed-effects model [6].

The operating conditions of economic subjects between industries and regions can fully reflect the level of regional economic development. Since UNAV (unit net asset value) is proportional to NAV, and NAV is the market value of the company's securities purchased by the fund asset. The estimation of UNAV is essentially an analysis of the market capitalization of listed companies through indicators such as total assets and profits, then a study of the economic development of regional industries by analyzing the economic agents of different regions.

2.2. Overview of Fund Valuation Theory

Fund valuation refers to the process of calculating and evaluating the value of fund assets and liabilities by the fair price to determine the net value of fund assets with shares, which is the key to calculating UNAV. The most crucial step for an accurate fund asset valuation is to choose the right fund valuation method. Fund valuation methods that have been studied include P/E valuation method, P/B valuation method, PEG valuation method, EV/EBITDA valuation method, etc[7]. By reviewing the existing literature, it is found that if the average daily price of stock trading is used as the valuation standard, NAV will be more volatile, which is not conducive for fund investors to view the Fund NAV from the perspective of a long-term trend. In view of this, this

study decided to use the H-P Filter Method to remove the cyclical fluctuations in the Fund NAV, so that the resulting NAV trend is more stable. On the basis of this time series data, Tobit and OLS models are constructed for regression analysis.

2.3. Literature Review

Scholars at home and abroad have expanded the regional economic differences from the time scale to the spatial domain, and gradually studied the industrial economy at the specific regional level from the national perspective to the provincial perspective, gradually developed from a single factor to the direction of multi-factor interconnection. In this paper, we analyze the role of regional industrial economies on geographical radiation by compiling statistics on profitability indicators such as the assets of securities issuing companies in which we hold positions.

Combined with the advantages and disadvantages of each evaluation method, this paper studies the relationship between the number of trading days of funds and the fluctuation of unit net asset value in a multi-dimensional manner through the H-P filter method and data standardization processing. The paper also uses the Symbolology tool to visualize the statistical data to reflect the regional radiation of geographical economies better.

3. RESEARCH DATA PROFILE

3.1. Sample Fund Profile

The China Securities Investment Fund Association classifies the risk level of fund products into R1, R2, R3, R4 and R5 based on product elements, performance fluctuations and other indicators. Among them, R1 is a cautious low-risk-rated product, R2 is a prudent medium-low risk-rated product, R3 is a balanced medium-risk-rated product, R4 is an aggressive medium-high risk-rated product, and R5 is an aggressive high-risk-rated product. In this paper, the selection of sample funds follows three principles: comprehensive coverage of risk level, geographically dispersed coverage, and widely contained fund companies. Select 15 fund products covering 12 fund management companies, including E Fund, Fullgoal Fund, GF Fund, Qianhai Kaiyuan Fund, Tebon Fund, Dacheng Fund, Golden Eagle Asset, Galaxy Asset, Yingda Asset, Huatai-Pinebridge Fund, Xinyuan Asset and Huatai Securities Asset. This article intercepts each fund's net unit value data for the period from 31 December 2020 to 31 December 2021 for analysis, after deducting non-trading days, for a total sample of 244. The specific sample funds selected are shown in Table 1.



Fig.1 Total Corporate Assets of Issuing Company (as of 2021)



Fig.2 Net Profit of Issuing Company in 2020-2021

As shown in Fig.1 and Fig.2, the markers in the graph indicate the interval of total assets and annual net profit of the enterprise, respectively, and the relative proportion of the markers is proportional to the radiation influence of the enterprise. Fig.1 indicates the latest total assets of the position-issuing company until this paper's deadline, and Fig.2 shows the annual net profit of the position-issuing company 2020-2021 period. The paper identifies the regions of the selected fund products based on the

geographical area of the issuance of the first largest shareholder of each fund, combined with the National Bureau of Statistics' East, Middle and West division criteria. At the same time, it is also clear from the graph that the sample funds are more distributed in the eastern part, especially in Beijing and Shanghai, while the distribution in the central-western regions is sparse.

Table 1 Fund Position Information and Geographical Statistics

Fund Code	Top 10 Ratio	Largest Shareholder	Max Ratio	Region
000300	5.65%	Oriental fortune	2.83%	West
090017	29.14%	Daqin Railway	8.02%	Middle
000476	9.06%	Everbright Bank	1.34%	East
002351	14.19%	Goertek Inc.	1.93%	East
003218	93.8%	Agricultural Development	32.8%	East

Bank				
210014	85.73%	Ministry of Finance, PRC	25.2%	East
519613	42.74%	China Development Bank	15.5%	East
110001	45.89%	Wuliangye	7.89%	West
009783	53.55%	Tibet Summit	9.8%	West
110025	55.44%	Northern Rare Earths	7.48%	Middle
001608	60.36%	Shanghai Jahwa	8%	East
460007	63.96%	Shanxi Fen Wine	9.49%	Middle
009693	33.55%	Shandong Heda	4.53%	East
006193	42.5%	Zhifei Biological Products	6.62%	West
005502	22.15%	Kweichow Mouta	3.72%	West

3.2. Research Data Sources

In this paper, the net unit value of 15 funds with five risk levels is selected as the research sample. The data relating to fund products come from the Tiantian Fund website, Juchao Information Website, and annual reports of listed companies, etc. The average net unit value of the

15 funds in this sample is between 0.5 and 6. Ten of them are in the middle of the overall fund market. The difference between the maximum and minimum UNAV with fund code 000300 is the largest, with the maximum value appearing on December 6, 2020 (1.557) and the minimum value appearing on September 29, 2021 (0.087). Among them, the standard deviation of code 110001 is 0.388, which fluctuates the most.

Table 2 Descriptive Statistical Analysis of Sample Net Value Data

Fund Level	Fund Code	Min value	Max	Average value	Standard	Median
R1(1)	000300	0.087	1.557	0.524	0.104	0.508
R1(2)	090017	1.253	1.821	1.480	0.183	1.390
R1(3)	000476	0.450	1.404	0.658	0.134	0.633
R2(1)	002351	1.589	1.741	1.660	0.042	1.654
R2(2)	003218	1.218	1.578	1.369	0.116	1.315
R2(3)	210014	1.405	2.100	1.730	0.223	1.645
R3(1)	519613	1.496	1.681	1.594	0.060	1.599
R3(2)	110001	4.397	5.834	5.158	0.388	5.146
R3(3)	009783	0.948	1.198	1.055	0.049	1.058
R4(1)	110025	1.000	2.049	1.384	0.256	1.317
R4(2)	001608	1.950	2.334	2.115	0.093	2.080
R4(3)	460007	2.874	3.956	3.451	0.254	3.484
R5(1)	009693	1.290	1.780	1.578	0.120	1.581
R5(2)	006193	1.490	1.789	1.627	0.066	1.614
R5(3)	005502	1.365	1.669	1.464	0.056	1.456

4. EMPIRICAL ANALYSIS OF FUND UNAV FORECASTS FOR ECONOMIES

4.1. Long-term Trend of Fund Net Unit Value

Hodrick and Prescott first proposed the H-P filter in analyzing the post-war social economy of the United States. It has since been widely used in the

macroeconomic analysis of long-term trends. The H-P filter method analyses the slow-moving trend of data variables, dividing the series into Trend and Cycle. It uses the simple smoothing principle to separate the data with different frequencies in the time series based on the time-series data, then obtains data with different nature [8]. In this paper, we firstly analyze the raw Fund UNAV data by the H-P filter method, and then do subsequent processing based on the long-term trend data.

Suppose the time series is $Z=\{z_1, z_2, \dots, z_t\}$, the periodic data are $T=\{t_1, t_2, \dots, t_t\}$, trend element data as $G=\{g_1, g_2, \dots, g_t\}$, then $Z=T+G, t=1,2,3,\dots,n$. The trend is defined as the solution to the minimization problem of the following equation.

$$\min\{\sum_{t=1}^n (z_t - g_t)^2 + \lambda \sum_{t=2}^n [(g_{t+1} - g_t) - (g_t - g_{t-1})]^2\} \quad (1)$$

λ is a natural number which is called a smoothing parameter. When $\lambda=0$, $Z_n=G_n$; When λ approaches infinity, the H-P filter degenerates into the least square trend estimation. In this paper, the value of λ is 14400. The original net value data selected are decomposed to obtain periodic fluctuation data and trend elements. The software used for data processing in this paper is Eviews10.0. The results are shown in Fig.3.

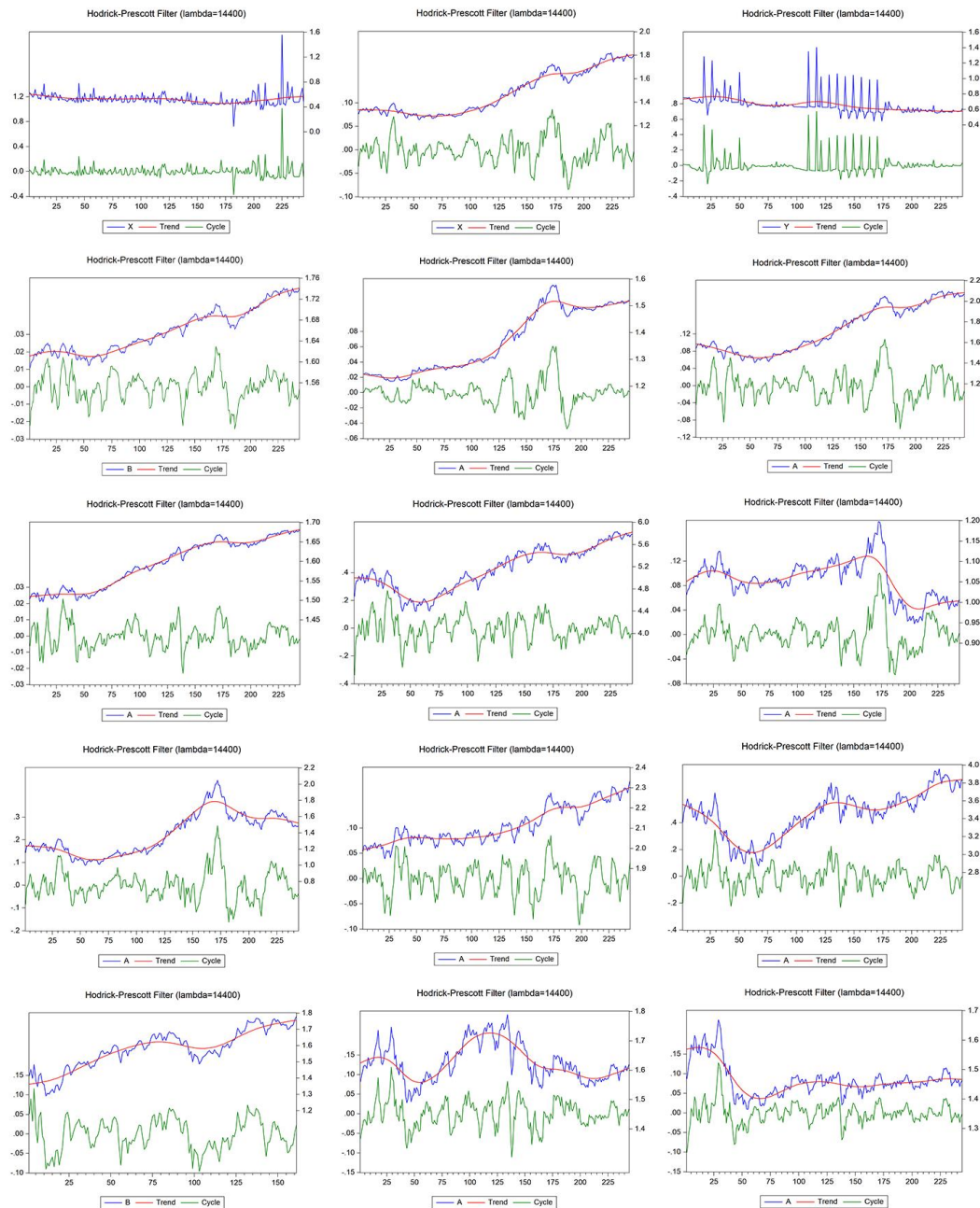


Fig.3 Long-term Trend of UNAV of the Regional Industrial Economies

It can be found from Figure 3 that the trend decomposed by H-P filter is smoother than the original net value trajectory, that is, the red curve represents the trend, the green curve is lower than the set periodic fluctuation trend, trend element sequence G is

represented by the red curve, and the periodic element sequence T is represented by the green curve. Analyzing the trend of the H-P filter shows that class R1 fund cycle fluctuations are extreme, R2, R3, R4 class net value trajectory. Besides, the long-term trend is generally

smooth, R5 class cyclical fluctuation is weaker than R1, but the historical net unit value fluctuation is large, which adds difficulty to the subsequent model prediction.

4.2. Forecast Analysis of Fund Net Unit Value

After H-P filtering analysis of the selected fund data, the decomposed data are fitted and predicted by OLS regression [9]. The regression results are shown in Table 3, where the explained variable is UNAV and the explanatory variable is the number of fund trading days. As shown in Table 3, each core coefficient is basically significant at its significance level. The core coefficient means that each additional day of the trading day, the unit net asset value increases (decreases) by A unit on average (A represents the core coefficient of each fund after regression analysis).

However, there were two problems in OLS analysis of selected fund data: first, after OLS regression, it was found that the data fitting degree of some funds was low, but the core coefficient was significant in the significance test of its core coefficient, indicating that the regression of some fund data was significant and meaningful, but it might not be used to explain the whole model; Second, the fundamental values of the core coefficients are small, basically starting to appear at the thousandth or even the ten-thousandth percentile, indicating that the core

coefficient still has the possibility of contingency. Therefore, in order to ensure the validity of the forecast, the Tobit model was used for robustness testing while predicting the unit net asset value [10]. The Tobit model is broadly divided into five categories. The truncated data model is chosen according to the characteristics of the data selected in this paper. The left truncated data structure is generally as follows:

$$y_i = y^*, \text{ if } y^* > L \quad (2)$$

The general form of the Tobit model is:

$$y^* = \beta x_i + u_i; y_i = y^*, \text{ if } y^* > L \quad (3)$$

where, y^* is the latent strain variable and takes the value y_i , which can be observed only when the latent variable is greater than L. x_i is the vector of independent variables, β is the coefficient vector, and the error term u_i obeys a specific distribution.

The results of the Tobit model test are shown in Table 3. Through the robustness test, we can conclude that the core coefficients obtained from the robustness test are consistent with the original core coefficients, indicating that they have good robustness. There is no significant difference between the Z-test and T-test values, meaning that their significance levels are the same, so the OLS method is continued to be selected for regression analysis.

Table 3 Forecast Analysis of UNAV of Regional Industrial Economies

OLS model					Tobit model		
Core	Coefficient	Std. Error	T-value	R ²	Coefficient	Std. Error	Z-value
R1(1)	-2.57×10 ⁻⁴	2.82E-05	-9.113	0.255	-2.57×10 ⁻⁴	2.82E-05	-9.150
R1(2)	2.38×10 ⁻³	5.89E-05	40.366	0.871	2.38×10 ⁻³	5.86E-05	40.532
R1(3)	-8.16×10 ⁻⁴	2.00E-05	-40.804	0.873	-8.16×10 ⁻⁴	1.99E-05	-40.972
R2(1)	5.64×10 ⁻⁴	9.42E-06	59.880	0.937	5.64×10 ⁻⁴	9.38E-05	60.127
R2(2)	1.54×10 ⁻³	3.22E-05	47.759	0.904	1.54×10 ⁻³	3.20E-05	47.956
R2(3)	2.91×10 ⁻³	6.96E-05	41.897	0.879	2.91×10 ⁻³	6.93E-05	42.069
R3(1)	8.26×10 ⁻⁴	1.14E-05	72.632	0.956	8.26×10 ⁻⁴	1.13E-05	72.932
R3(2)	4.66×10 ⁻³	1.56×10 ⁻⁴	29.807	0.786	4.66×10 ⁻³	1.56×10 ⁻⁴	29.930
R3(3)	-2.42×10 ⁻⁴	3.00E-05	-8.060	0.212	-2.42×10 ⁻⁴	2.99E-05	-8.094
R4(1)	2.76×10 ⁻³	1.31×10 ⁻⁴	21.094	0.648	2.76×10 ⁻³	1.30×10 ⁻⁴	21.180
R4(2)	8.38×10 ⁻⁴	5.11E-05	16.423	0.523	8.38×10 ⁻⁴	5.08E-05	16.491
R4(3)	2.42×10 ⁻³	1.42×10 ⁻⁴	17.118	0.548	2.42×10 ⁻³	1.41×10 ⁻⁴	17.189
R5(1)	2.20×10 ⁻³	6.19E-05	35.479	0.888	2.20×10 ⁻³	6.15E-05	35.702
R5(2)	-1.29×10 ⁻⁴	4.54E-05	-2.850	0.032	-1.29×10 ⁻⁴	4.52E-05	-2.862
R5(3)	2.33×10 ⁻⁴	3.73E-05	-6.254	0.139	2.33×10 ⁻⁴	3.72E-05	-6.280

Based on the results of the analysis, the empirical forecasts of the fund net unit values are made for the 1st and 6th trading days in the future, i.e., the 245th and 250th trading days, corresponding to the trading dates of January 4, 2022, and January 11, 2022, respectively, using the results for forecasting, along with the Tobit Model for robustness testing. The 1st future trading date corresponds to day 245 of the overall parameters, at which time the net unit values of each fund are predicted

using OLS to be 0.492, 1.771, 0.558, 1.729, 1.558, 2.085, 1.695, 5.730, 1.026, 1.722, 2.260, 3.747, 1.939, 1.610, 1.435, respectively. The 6th future trading date corresponds to day 250 of the overall parameters, at which time the net unit values of each fund are predicted using OLS to be 0.491, 1.783, 0.554, 1.732, 1.566, 2.100, 1.700, 5.753, 1.025, 1.736, 2.266, 3.759, 1.950, 1.610, 1.434, respectively. Compared with the actual value, the maximum difference between the estimated value and the

real value of 245 days is 0.2522, which is R4(1) net forecast value. The minimum is 0.006795, which is R5(2) net forecast value. The maximum difference between the estimated and true values of 250 days is 0.299, which is R4(1) net forecast value. The minimum is 0.006, which is R2(1) net forecast value. The model is of great significance for predicting the trend of the net fund value

in the short term.

4.3. Heterogeneity Analysis of UNAV

After the periodic fluctuation is removed by the H-P filter method, the data are standardized to compare regional differences among the data.

Table 4 Heterogeneity Analysis of Regional Industrial Economies under Different Geographic Regions

Variable	Coefficient	Std. Error	T-value	R ²
R1(1)	-7.161×10 ³	7.86×10 ⁴	-9.113	0.255
R1(2)	1.322×10 ²	3.28×10 ⁴	40.366	0.871
R1(3)	7.350×10 ³	3.11×10 ⁴	-23.595	0.605
R2(1)	1.371×10 ²	2.29×10 ⁴	59.880	0.937
R2(2)	1.347×10 ²	2.82×10 ⁴	47.759	0.904
R2(3)	1.328×10 ²	3.17×10 ⁴	41.897	0.879
R3(1)	1.385×10 ²	1.91×10 ⁴	72.632	0.956
R3(2)	1.232×10 ²	4.16×10 ⁴	29.635	0.784
R3(3)	6.518×10 ³	8.09×10 ⁴	-8.060	0.212
R4(1)	1.140×10 ²	5.41×10 ⁴	21.094	0.648
R4(2)	1.027×10 ²	6.26×10 ⁴	16.423	0.527
R4(3)	1.049×10 ²	6.13×10 ⁴	17.118	0.548
R5(1)	2.021×10 ²	5.70×10 ⁴	35.479	0.889
R5(2)	-2.554×10 ³	8.96×10 ⁴	-2.850	0.032
R5(3)	-5.285×10 ³	8.45×10 ⁴	-6.254	0.139

Looking at the values after regression analysis in Table 4, the core coefficients of R1(1), R5(2), R5(3) are negative. In other words, the number of trading days of the fund is negatively correlated with UNAV. Comparing the above three funds with R3(3) shows that the R² value in the western region is generally less than 0.5. It shows that the OLS regression model has a poor-fitting effect for the western region, that is, there is little relationship between the number of trading days of the fund in the western region and Fund UNAV. On the contrary, for the central-eastern regions, the core coefficients of regression are all positive and the value of R² is above 0.5, indicating that the regression fitting effect is good. The standard error value is also generally small, which means a greater correlation between the number of trading days and UNAV.

5. CONCLUSION

In this paper, the unit net value data of 15 open-market funds in 2021 of five fund grades R1 to R5 are selected to study the fluctuation trend of fund net value. H-P filter method was adopted to decompose the random fluctuations. Then long-term trend data were used as the explained variables. After OLS regression with Tobit model robustness test, the following research conclusions were drawn.

1. East, central and western regions of the fund

development difference is large, so the number of related funds is also decreasing. The radiating effect of the industrial economy on social development in central-western regions is far less than that in eastern regions.

2. The fitting degree of the fund prediction model in the western region is much lower than that in the central and eastern regions. Besides, the stability of the fund in the west region is poor.

3. The fit of the model is relatively higher for R2-R4 funds. In addition, R1-R5 funds have high-risk funds with low income and low-risk funds with high income.

In response to the findings, this paper also provides corresponding policy recommendations.

1. The country should increase its support to the less developed areas. On the premise of ensuring the economic development and stability in the east, the government should increase the financial transfer payment to the less developed areas in the west to support infrastructure investment. While guiding the utilization of resources, appropriate arrangements should be made for crucial national development projects in the western region to promote positive interaction between areas.

2. As the impact of the fund's position ratio on the fluctuation of the fund's performance is dynamic, in order to ensure the robustness of the fund's return, the fund's position can appropriately increase the proportion of

sunrise industries in the eastern region and pay attention to a more balanced. At the same time, fund managers should carefully select the top shareholder, including the percentage of shares held by the top shareholder, to balance the relationship between reducing risk and increasing returns.

3. Looking at the types of R1-R5 funds, it can be found that China's fund market cannot fully reflect the correlation of financial assets between high risk and high return, low risk and low return, which reflects the uneven trading level of different funds. Fund managers should have good investment ideas, reasonable control of the macro market and prospects of different industries so that the management products have a better risk-return performance ratio.

Of course, there are also shortcomings in this study. Firstly, the study in this paper is based on the data of 15 open-market funds selected in 2021, which may lead to the contingency of model results due to force majeure and other factors. Secondly, the model only considers the fund trading days as an explanatory variable, so the external factors are relatively single. In this paper, the analysis of the regional industrial economies through fund valuation and fundholding subjects is more of an exploration in the way of thinking. These two aspects will also serve as a breakthrough in the follow-up research to reference the valuation study of financial investment products.

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