New Energy Industry Fund Net Value Movement and Forecast Analysis——Empirical analysis based on data from a sample of 3645 from 2021-2022

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Abstract. With the intensification of the energy crisis and environmental problems, the strategic importance of the new energy industry gradually increased. The financial industry can effectively lead the development of the new energy industry, which has a significant role in the real economy. This paper analyzes the development trend of the new energy industry by studying the change of fund net value in the emerging energy finance field and puts forward corresponding suggestions. This paper first selects 15 representative funds in the new energy sector, counts their net value per unit on trading days in 2021, and conducts empirical analysis using the 3645 sample data obtained. The HP filtering method is used to eliminate short-term and cyclical fluctuations. The short-term and cyclical fluctuations are eliminated using the HP filtering method, and long-term trends are selected as explanatory variables. Considering data characteristics and fixed effects, the truncated Tobit model is selected for fitting; robustness tests are conducted by transforming sample data; finally, heterogeneity tests are conducted by dividing fund size. The following conclusions are obtained: ① The overall direction of new energy sector funds is good, with a long-term trend of stable growth; ② Funds are susceptible to interference from external factors, which has an impact on the forecast; ③ The head enterprises of the new energy industry are more concentrated, and the fund sector shows uniformity.

Keywords: New Energy Industry; Fund Net Worth Forecasting; HP Filtering Method; Tobit Model.

1. Introduction

Energy is the material basis for human survival and development. However, the energy crisis and environmental problems have become more severe. New energy can replace traditional resources and make up for the energy shortage, effectively reducing the environmental pollution problems caused by the use of traditional energy [1]. Therefore, in recent years, the new energy industry has received attention from various governments, and the Chinese government has also included the new energy industry as a strategic emerging industry for national development. Against this backdrop, the importance of developing a new energy industry is evident [2].

The development of the new energy industry requires comprehensive support from various aspects such as resources, technology, management, and finance. As the core of modern economic development, it can efficiently guide the scale development of the physical new energy industry and proliferate rapidly by effectively playing its supporting role [3].

By studying the development of new energy sector funds, we can effectively assess the new energy industry's development status and future direction and put forward policy recommendations; moreover, energy finance is a new research field with relatively few achievements in corresponding research [4].

Thus, this paper fits and predicts the net unit value of new energy sector funds, builds a relevant model, obtains corresponding conclusions, and proposes corresponding policy recommendations to promote the development of the new energy industry with financial research.

2. Literature review

2.1 Fund Investment Risk and Investment Strategy

In the Chinese capital market, the actual portfolio risk taken by fund managers is often lower than their investment strategy risk, and funds are primarily risk-averse (Li, 2006); when considering the market state, some fund managers tend to take the initiative to make risk adjustment in bear markets, which brings significant improvement in performance, and are not so cautious in bull markets (Liu, Shasha, Liu, Yuzhen, Tang, 2013); this is closely related to the complexity of securitized products and the high risk brought by high leverage (Feng, 2017)

The investment strategies adopted by fund managers and how well each strategy performs have generated widespread market attention. Through an empirical study of performance and fund managers' investment strategies, Fang Junxiong (2002) found no significant correlation between the two, and profits are mainly made by the general market movements to chase up and down. By studying fund trading behavior, Huang Jing and Gao Fei (2005) found that good industry prospects and high growth industries are the critical factors for fund rallies; selecting head fund companies for investment strategy research, Qi Yue and Sun, Xinming (2016) further illustrate that there is a convergence of investment strategies among fund companies, and fund growth is mainly due to industrial economic development. Therefore, studying the changes of related funds may better reflect the direction of specific industries and future trends.

2.2 Fund Risk Classification, Net Worth and Valuation Methodology

2.2.1 Fund Risk Classification and Net Worth

The safety risk calculation function R can classify the fund into five levels, R1-R5. R1 and R2 are low-risk; R3 is medium-risk; R4 and R5 are medium-high and high-risk.

Fund NAV can be divided into cumulative NAV and unit NAV. The cumulative NAV mainly reflects the fund's cumulative return since inception, while the unit NAV mainly reflects the fund's current return. NAV per unit is affected by a variety of factors. From the market perspective, there is a long-term coordination relationship between the growth ability of open-end funds and market returns (Xiao, Kui-Hsi, 2007); from the macro and micro perspectives, it can be decomposed into macroeconomic variables, securities market, fund size, fund manager and other factors (Yang, N., 2012). Furthermore, the study of fund direction and trend can effectively reflect the investment value of the fund and even of the corresponding sector.

2.2.2 Fund Net Worth Forecasting Methodology

Funds have been developing in recent years, and fund NAV forecasting has become a popular research topic. Recently, in the research, the time series method in econometrics can be used to achieve better results. However, it is easy to receive the influence of fund volatility. It can also be achieved by computer means and mathematical models, such as neural networks, which determine the trend of fund changes (Wang Bo, 2007). With the help of wavelet analysis for denoising and smoothing (Qiao Baoming, Huang Jing, Fan Wen, 2010), such methods predict better short-term results But there is also a certain instability.

2.3 Summary of the literature

Domestic and foreign researchers in the fund investment risk, investment strategy and other aspects of the main focus on the combination of funds and financial markets, the general stock market, from a variety of factors, a variety of perspectives to study the development of funds and changes in fund net value; and fund net value as the most representative of the fund performance indicators, in recent years, the gradual development of forecasting tools, closely integrated with the field of quantitative investment, in the short-term forecast and stability have made specific achievements.

Through the research, it is found that there is relatively little literature on the study of corresponding industry development through financial and related products, and this is especially true

for corresponding studies in the field of energy finance as a recent emerging research area. However, from a financial perspective, corresponding industry research on a crucial trading product such as funds can play an essential role in promoting the development of the real economy. It is the starting point of this research

3. New Energy Industry and Research Data

3.1 Overview of the new energy industry

As the strength of China's new energy industry continues to grow and the system continues to improve, and the industry chain covering a variety of industries has gradually formed. Combing the industry chain relationship, the new energy industry can be divided into upstream, midstream, and downstream. Where the upstream is material development and processing production, etc., the midstream is equipment manufacturing, technology development breakthroughs, etc., and the downstream is focused on new energy vehicles, battery consumption, etc. [5-6]

3.2 Study data and descriptive statistics

In view of the above industry analysis, various factors were considered for fund selection.

1) Five representative new energy segment indices were selected: energy storage, photovoltaic, wind power, new energy vehicles, and batteries. Three leading funds were selected for each corresponding area for stratified sampling.

2) Selecting funds with different fund companies, multiple risks, and multiple components for better representation

3) The selected funds have good timeliness and can better reflect the changes in the development of the new energy industry.

Fund product-related data is mainly from the Daily fund network, Wind, Huaxi Securities, and other websites. A total of 243 trading days of fund unit net value, return information, and other related data in 2021 were counted. A total of 3645 research data samples were obtained.

Descriptive statistics are shown that the average of the 15 funds is between 1 and 4, which is in the middle of the commercial marketplace. The fund with the most significant extreme deviation and the standard deviation is 400015, which is the most volatile fund; 001158 has the minor extreme deviation and the standard deviation, the least volatile fund. From the data in the table, we can see that the 15 funds have distinct characteristics, and the selection is appropriate.

Table 1 Descriptive statistics of funds

Fund	Min	Max	Mean	Standard error	Median
000696	1.886	3.275	2.646	0.428	2.708
000689	1.450	3.757	2.522	0.795	2.538
501057	1.809	3.462	2.692	0.532	2.776
398051	1.816	3.242	2.549	0.466	2.506
515790	0.992	1.894	1.413	0.297	1.354
001856	2.762	4.609	3.685	0.582	3.521
515030	1.388	2.691	2.080	0.423	2.138
400015	2.296	4.979	3.692	0.877	3.777
161028	0.895	1.667	1.306	0.250	1.341
002190	2.272	4.766	3.546	0.830	3.481
001158	1.290	1.930	1.654	0.189	1.684
005600	2.080	3.192	2.692	0.311	2.770
515700	1.746	3.462	2.659	0.554	2.747
160634	1.060	1.876	1.463	0.275	1.456
163114	1.095	1.931	1.509	0.279	1.505

4. Empirical analysis of new energy industry fund unit net value forecast

HP filtering was first proposed by Hodrick and Prescott (1920, 1977) when analyzing the post-war socio-economic cycles in the U.S. The method is theoretically based on spectral analysis methods and can effectively decompose the long-term trends of economic change time series. It was later widely used to analyze macroeconomic trends and applied to situations where economic data reflected both a certain degree of regularity and a certain degree of randomness and volatility.

The characteristics of this paper are: first, the study is aimed at the overall change of the new energy industry, and second, the data changes are both volatile and show volatility and randomness. Therefore, the HP filtering method is chosen to fit the trend term of fund net value growth well.

The basic principle is as follows.

Let the economic time series be:

$$Y = \{y_1, y_2, \cdots, y_n\} \tag{1}$$

The trend elements are:

$$G = \{g_1, g_2, \cdots, g_n\} \tag{2}$$

Where n denotes the sample size.

Decomposition by HP filtering:

$$y_t = g_t + c_t \tag{3}$$

On the right-hand side is unobservable values.

The HP filtering problem minimizes the following loss function:

$$\mathrm{Min}\{\sum_{t=1}^{n}(y_t - g_t)^2 + \lambda \sum_{t=1}^{n}[(g_{t+1} - g_t) - (g_t - g_{t-1})]^2\} \tag{4}$$

The above equation, which λ is called the smoothing parameter, is used to adjust the weights of the two terms in the above polynomial [7].

The collected fund unit NAVs were analyzed and visualized using Eviews 10.0, one of which was selected as an example and presented as follows:

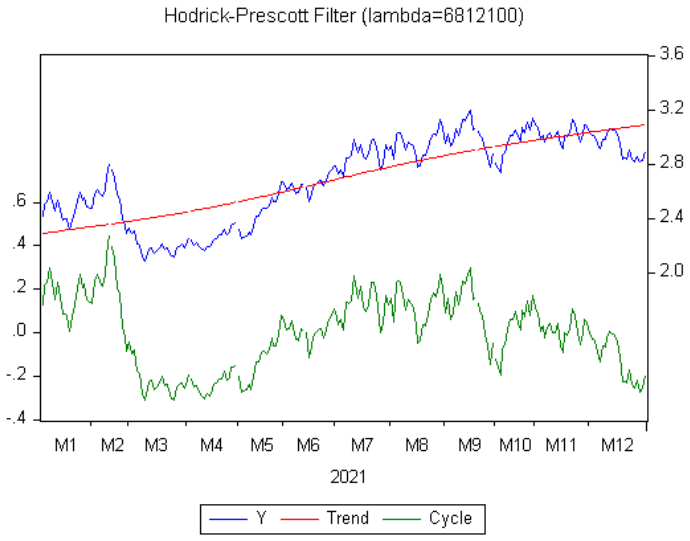


Figure 1 Long-term trend of the fund's net unit value by the HP filtering method

In Figure 1, the blue curve indicates the net unit value of the fund (Y), the red curve indicates the time trend element of the fund (Trend), and the green curve indicates the cycle trend element of the net unit value (Cycle).

By analyzing the above chart, it can be seen that the fund Trend curve of the fund shows an upward trend in the long term in 2021, and the increase is obvious; the fund has high short-term volatility.

Using the same method to obtain Trend graphs of other funds, the analysis shows that the new energy industry fund shows an upward trend in the long term, with a more pronounced increase; and the overall volatility is consistent. It shows that there is a certain similarity within the whole new energy industry fund as well as the segmentation fund.

4.1 Forecast analysis of the fund's net unit value

To forecast the fund net value, the truncated data model in the Tobit model is selected considering the data characteristics, and the data structure is:

$$y = y^*, \text{if } y^* > L \tag{5}$$

Its common functional form is:

$$y^* = x\beta + \varepsilon, \quad \text{if } y^* > L \tag{6}$$

Where the parameter εobey some specific distribution [8].

Also, the Hausman test was performed on the data during the model setting process, considering the effect of fixed effects.

The Tobit model is used to predict the net unit value of 15 funds, and the regression results are shown in the table below, where the explanatory variable is the net unit value of the fund, and the explanatory variable is the fund trading day. The model is significant at the 1‰ level with a small standard deviation, indicating a good fit. The core coefficients in the table below indicate that the net value of fund units increases/decreases by a unit for each additional day of trading, and the positive core coefficients in the table indicate that the fund shows an upward trend.

However, there are specific problems when fitting the Tobit model to the selected fund data: first, the absolute value of the core coefficients is small, and the values start to appear at the thousandth percentile, so their core coefficients may still have the chance of the model; second, despite considering the long-term time series trend, the volatility of the fund is still more evident due to a variety of external factors such as policies and epidemics. Therefore, in this paper, the trading data of October, November, and December 2020 for each fund are selected for Tobit fitting by switching variables and compared with the fitted model in 2021 to complete the robustness test

Table 2 Table 2 Comparison of robustness tests

	Tobit		Data Transformation		Fixed
Fund	Core Factor	Standard Error	Core Factor	Standard Error	Prob>F
000696	3.41×10-3	1.41×10-4	4.55×10-3	3.10×10-4	0.0000
000689	7.01×10-3	1.77×10-4	3.77×10-3	3.52×10-4	0.0000
501057	4.37×10-3	1.62×10-4	6.12×10-3	3.20×10-4	0.0000
398051	3.80×10-3	1.44×10-4	5.26×10-3	3.66×10-4	0.0000
515790	2.42×10-3	9.20E-05	6.65×10-3	1.12×10-3	0.0005
001856	4.71×10-3	1.83×10-4	5.92×10-3	3.08×10-4	0.0001
515030	3.51×10-3	1.24×10-4	4.98×10-3	2.66×10-4	0.0064
400015	7.21×10-3	2.65×10-4	8.66×10-3	4.65×10-4	0.0000
161028	2.07×10-3	7.38E-05	2.75×10-3	6.69×10-4	0.0000
002190	7.16×10-3	2.08×10-4	6.66×10-3	5.78×10-4	0.0000
001158	1.43×10-3	6.85E-05	3.32×10-3	1.58×10-4	0.0701
005630	2.37×10-3	1.13×10-4	2.54×10-3	3.21×10-4	0.0237
515700	4.55×10-3	1.64×10-4	6.29×10-3	3.27×10-4	0.0000
160634	2.36×10-3	7.05E-05	1.28×10-3	1.81×10-4	0.0001
163114	2.41×10-3	6.95E-05	2.26×10-3	2.03×10-4	0.0001

The above table shows that the core coefficients change less overall in the thousandth percentile and above after data transformation. The standard errors increase in some funds, but the impact is small. The model still presents significant at the 1 per thousand level with no essential difference in terms of the significance level. Meanwhile, the data were subjected to the Hausman test, and it was found that the sample's overall fixed effect significance level was high after the test.

The truncated Tobit model was chosen as the core model for forecasting with good robustness.

Using the above models, the net value of fund units is forecasted, and the 1st and 10th trading days after that, i.e., 2022.1.4 and 2022.1.17, are selected for forecasting.

Table 3 Tobit model predictions

Fund	04/01/22 Real	04/01/22 Predict	17/01/22 Real	17/01/22 Predict
000696	2.876	3.2698	2.838	3.3142
000689	3.414	3.8041	3.329	3.8953
501057	2.985	3.4904	2.962	3.5472
516880	1.346	1.5412	1.283	1.5677
515790	1.626	1.8554	1.551	1.8869
001856	4.086	4.5476	3.918	4.6089
515030	2.304	2.7224	2.282	2.7681
400015	4.173	5.0112	4.092	5.1050
161028	1.437	1.6853	1.424	1.7123
002190	4.292	4.8570	4.224	4.9500
001158	1.803	1.9158	1.703	1.9344
005630	2.790	3.1246	2.625	3.1578
515700	2.978	3.4914	2.950	3.5505
160634	1.709	1.8949	1.670	1.9255
163114	1.758	1.9502	1.718	1.9815

Analysis of the prediction results reveals that the difference between the predicted and actual values of the funds is minor in the short term and more subtle in the funds with smaller net values.

Meanwhile, considering the opening year of 2022 due to the impact of external factors such as the significant increase in the early period institutional mobilization of funds to change the track, the Federal

Reserve interest rate increase and market policies [9] led to a sharp decline in the opening year of new energy industry funds, but in the long term, the growth trend of new energy funds is evident. The industry is on a stable and cheerful threshold. The established fund prediction model still has essential significance.

4.2 Heterogeneity analysis of the fund's net unit value

To explore the heterogeneous relationship between the model and fund size, the relationship between net value change and size is investigated by sorting funds according to their size. It is consistent with the previous paper, and we firstly use the HP filtering method to remove cyclical fluctuations, which uses long-term time series as the explanatory variables. Then, standardize the fund unit net value, use the Tobit model, the core model of this paper, for regression, and then group the core coefficients, standard deviations, and other factors for F-test, and present the obtained results in the following table.

Table 4 Fund heterogeneity analysis

Group	Fund	Fund size	Core factor	Standard error	Z-Value
A	163114	5.17	8.64×10-3	2.49×10-4	34.64395
	160634	5.32	8.59×10-3	2.57×10-4	33.44616
	005630	11.85	7.60×10-3	3.62×10-4	20.97093
	001158	23.70	7.59×10-3	3.63×10-4	20.91471
	398051	26.94	8.10×10-3	3.08×10-4	26.46332
B	000696	58.62	7.97×10-3	3.29×10-4	24.22088
	515700	67.56	8.26×10-3	2.97×10-4	27.79235

	001856	73.48	8.10×10-3	3.15×10-4	25.68670
	515030	95.79	8.30×10-3	2.93×10-4	28.32812
	501057	106.74	8.20×10-3	3.04×10-4	26.97254
	161028	109.54	8.28×10-3	2.95×10-4	28.07620
	000689	125.09	8.81×10-3	2.23×10-4	39.51958
C	515790	141.36	8.15×10-3	3.10×10-4	26.25850
	400015	224.41	8.22×10-3	3.10×10-4	27.23384
	002190	287.52	8.83×10-3	2.50×10-4	34.51651

Table 5 Test for differences in subgroups

Variable	Group	F-value	P-value
Z-Value	A B C	1.130	0.355
Standard error	A B C	1.005	0.395
Core factor	A B C	1.065	0.375

The data in the table shows that the Z-value has increased to different degrees, and the standard error remains small, indicating that the core model fits the funds of different sizes better and correlates well, while the significance level remains at the 1 per thousand level. The core coefficients of the funds are similar in size, with little difference in volatility. F-test found no significant differences between the groups of funds. It is related to the overall nature of the new energy industry, and the head companies are concentrated, the fund's long positions in stocks held similarly.

5. Conclusion

In this paper, based on the existing classification of the new energy industry, comprehensive statistics of 15 funds' net unit value changes in 2021 trading days are used as data samples. HP filter method and Tobit model are used as core methods to fit and forecast funds, robustness tests are conducted by transforming data samples, and fund size is divided for heterogeneity analysis. Thus, conclusions are obtained, and corresponding policy recommendations are made.

5.1 Research findings

1. At present, the new energy industry fund in the market is in the small and medium scale, from the long-term development, the new energy industry fund is in a stable growth stage.

2. The model in this paper has a high degree of fit to the fund, and the standard error is small. Thus, the prediction results are satisfactory. However, various external factors lead to large fluctuations in the fund, causing a certain amount of prediction bias.

3. The new energy fund shows a holistic nature, and the trend of net value fluctuation of different funds is consistent.

5.2 Policy Recommendations

1. New energy industry is still in the development and perfection stage, should continue to make investments and improve the corresponding facilities, laws, and regulations, and vigorously promote the development of new energy industry [10], which is of great significance to the financial market and the country's real economy.

2. The recent volatility of new energy industry funds, considering the impact of various external factors such as the return of the US dollar interest rate hike, institutional change of track, and policy opinion guidance, traders should make timely investment strategy adjustments to ensure industrial stability.

3. The overall nature of the new energy industry is prone to cause overall sector drawdown retracement, which requires fund companies and fund managers to focus on corporate development and control from the macro.

Meanwhile, there are certain shortcomings in this paper's research. First, there are still certain limitations in the selection of funds; second, the data study was selected only for the 243 trading days of the year 2021, which has a certain chance and lacks the subsumption study of the data since the establishment of the fund; third, the explanatory variables are considered relatively single.

This paper aims to put forward particular suggestions for the development of this industry through the analysis and forecast of new energy industry funds and provide specific reference values for the future study of financial products trading in this industry.

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