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Research on the Performance Persistence of China's Funds

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Abstract

This paper research the Chinese funds' persistence of performance based on "mover-stayer" model in years. We found that Chinese founds has weak persistent, follows: the medium founds group has the weakest persistent of performance, the best founds group has a medium persistent, and the poor mover founds group has the strongest persistent. But the persistent of performance decrease gradually with the extension of the study period.

Key words: Funds; Persistence of performance; Mover-stayer model

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INTRODUCTION

With the reform of China's financial market and continuous improvement, the fund industry is booming, but the research on fund field is not perfect. From the theory aspect, domestic and foreign fund research about performance persistence of funds has been mature, but based on the complexity of the domestic financial market; research on China's fund industry is still not deep enough. Therefore, this paper research the performance persistence of Chinese funds based on the "mover-stayer" model, aims to explore China's fund market, and provide theoretical basis for investors.

For the fund performance measurement, the commonly used index is the average rate of return, Sharpe index and Treynor index. From the related research abroad, Grinblatt and Titman (1989, 1992, 1995) with 5 years as a period, in different combinations, they found fund has a certain continuity. At the same time, Droms and Walker (2001) also found that the fund performance has short persistence, but not significant. Hendricks, Patel and Zeckhauser (1993) used the method of test cross section regression and Spearman rank correlation coefficient for performance persistence of funds, the results show that there is no evidence support the fund performance persistent; In China, Li, Fang, and Yu (2006) introduced the scan statistic analyze a single fund, found persistence is the phenomenon of a small part of fund performance, and the poor performance of the fund more sustainable. Wang (2007) selected 13 funds established before 2004, by using the method of Spielman rank test on fund performance persistence, and had the conclusion that the absolute performance of open-ended fund overall in China is not persistent

In general, the Public opinions are divergent at the conclusion of fund performance persistence. As the development of China's fund industry compared with foreignhistory is short, the market needs to be improved, this paper is more practical significance. "mover-stayer" model was first applied to the fund in 2005, Taiwan scholar Guo and Keri (2005) used this model to research Taiwan open-end fund performance persistence, the conclusion is accurate, and is of great reference value. This paper refers to "mover-stayer" model to analyze the domestic fund performance persistence, the transition probability of fund performance is divided into 5 groups to calculate different grades and retention ratio, and the result is further accurate.

1. "MOVER - STAYER" MODEL

"mover-stayer" model is a discrete time stochastic process, which consists of two independent Markov chain. One of the transfer matrixes of a Markov chain is a unit matrix, that means the fund has been staying in the same group; another Markov chain is used to describe the movement behavior of funds, indicate the probability of "move funds" that in different groups. Remember this process for $\{R(t), t\geqslant 0\}$, assuming the i group funds' retention ratio is λ_i, and then can get the transfer probability:

$$p(R(t)=j\mid R(0)=i)=\begin{cases}(1-\lambda_i)p_{ij}^{(t)} & i\neq j\\ \lambda_i+(1-\lambda_i)p_{ii}^{(t)} & i=j\end{cases}. \quad (1)$$

Among them, t=1, 2,$\cdots T$, $1\leqslant i, j\leqslant k$, k is the group number, $\| p_{ij}^{(t)}\| = p^t$ is the t square of the transfer matrix, $\lambda_i\in[0,1]$. Define the following variables:

$n_{i_0,\cdots i_T}$: In the sample period, the number of fund that performance in $(i_0,\cdots,i_T)$ groups;

$n_i(t)$: At time t, the number of fund that performance in the i group;

n_i: The number of fund that performance always stays in the i group;

n_{ij}: All the sample interval, the number of funds that performance transfer from i group to j group;

n^*_i: From the first phase to phase K, the number of fund that performance once stays in the i group;

n^0_i: The number of fund that initial performance stays in the i group.

Assume the investment process of fund managers are independent and not affected each other, the random variable $(n_{i_0,\cdots,i_T}:(i_0,\cdots,i_T)\in S^{T+1})$ is multivariate probability distribution; the density function can be expressed as:

$$\pi_{i_0,\cdots,i_T}=p(R(0)=i_0,\cdots,R(T)=i_T)=\begin{cases}\lambda_i\theta_i+(1-\lambda_i)\theta_i p_{ii}^T & i_0=i_1=\cdots=i_T\\ (1-\lambda_i)\theta_i p_{i_0i_1}\cdots p_{i_{T-1}i_T} & else\end{cases}. (2)$$

Which $\{\theta_i\geq 0, 1\leq i\leq k; \sum_{i=1}^k\theta_i=1\}$ is the initial probability of $\{R(t), t\geqslant 0\}$. Then the likelihood function can be expressed as follows:

$$L=\prod_{i=1}^k[\lambda_i\theta_i+(1-\lambda_i)\theta_i p_{ii}^T]^{n_i}\prod_{\substack{(i_0,\cdots,i_T)\in S^{T+1}\\ i_m\neq i_n;\forall m,n}}[(1-\lambda_i)\theta_i p_{i_0i_1}\cdots p_{i_{T-1}i_T}]^{n_{i_0\cdots i_T}}. (3)$$

Rewriting (3) then:

$$\begin{aligned}L&=\prod_{i=1}^k\theta_i^{n_i^0}\prod_{i=1}^k[\lambda_i+(1-\lambda_i)p_{ii}^T]^{n_i}\times\prod_{i=1}^k(1-\lambda_i)^{n_i^0-n_i}\prod_{i=1}^k p_{ii}^{n_{ii}-Tn_i}\prod_{i\neq j}p_{ij}^{n_{ij}}\\&=\prod_{i=1}^k\theta_i^{n_i^0}\prod_{i=1}^k L_i\end{aligned} \quad (4)$$

Which $L_i=[\lambda_i+(1-\lambda_i)p_{ii}^T]^{n_i}\times\prod_{i=1}^k(1-\lambda_i)^{n_i^0-n_i}\prod_{i=1}^k p_{ii}^{n_{ii}-Tn_i}\prod_{i\neq j}p_{ij}^{n_{ij}}$

Taking the logarithm of L_i, we can get the following log likelihood function:

$$\ln L_i=n_i\ln[\lambda_i+(1-\lambda_i)p_{ii}^T]+(n_i^0-n_i)\ln(1-\lambda_i)+(n_{ii}-Tn_i)\ln p_{ii}+\prod_{i\neq j}n_{ij}\ln p_{ij} \quad (5)$$

According to Frydman (1984) iterative principle, in order to calculate the parameters in the model, firstly, differential (5) on λ_i, then can get the estimated value for λ_i:

$$\lambda_i=\frac{n_i-n_i^0p_{ii}^T}{n_i^0(1-p_{ii}^T)}. \quad (6)$$

(6) fed into (5), differentiate (5) of $p_{i,k\text{-}1}$, then can get the estimated value for $p_{i,k\text{-}1}$. Differentiate (5) of $p_{i,k\text{-}2}$, $p_{i,k\text{-}3}$, $\cdots p_{i,1}$ in accordance with the above steps, we can get the estimated value of differential parameter. We need to let the estimated value fed into (5) be differentiate (5) of the next parameters. According to the above iterative techniques, we can get:

$$p_{ij}=\frac{n_{ij}(1-p_{ii}-\sum_{q=1,q\neq i}^{j-1}p_{iq})}{\sum_{q=1,q\neq i}^{k}n_{iq}}. \quad (7)$$

(7) fed into (5), simplify (5) and can get that L_i only be affected by p_{ii}. Differentiate (5) of p_{ii} once more, we can get the following important parameter estimation equation:

$$[n_i^*-Tn_i^0]p_{ii}^{T+1}+[Tn_i^0-n_{ii}]p_{ii}^T+[Tn_i-n_i^*]p_{ii}+n_{ii}-Tn_i=0. \quad (8)$$

If k is the group number, the number that has the form of equation (8) is k, parameters of each equation can be solved. The obtained parameters of $\hat{p}_{ii}$ fed into (7), according to the iterative techniques, we can obtain $\hat{p}_{ij}$ as follows:

$$\hat{p}_{ij}=\frac{n_{ij}(1-\hat{p}_{ii}-\sum_{q=1,q\neq i}^{j-1}\hat{p}_{iq})}{\sum_{q=1,q\neq i}^{k}n_{iq}}, \quad (9)$$

While estimate the value of $(p_{11},\cdots, p_{kk})$, the ratio of performance of stay funds of each group can be obtained :

$$\hat{\lambda}_i=\frac{n_i-n_i^0\hat{p}_{ii}^T}{n_i^0(1-\hat{p}_{ii}^T)}. \quad (10)$$

Thus, the relevant parameters in the model of "mover-stayer" have been estimated by maximum likelihood method.

In large samples, estimated values of the above parameters asymptotically obey normal distribution, namely $\hat{\theta}_{MLE}\to N[\theta, F_{\theta\theta}^{-1}(\theta_0)]$, which $F_{\theta\theta}(\theta)=-E[\frac{\partial^2\ln L(\theta)}{\partial\theta\partial\theta'}]$ is the Fisher information matrix. Differentiate (5) in two derivatives, we can get:

$$\frac{\partial^2 \ln L_i}{\partial \lambda_i \partial \lambda_i} = \frac{-n_i(1-p_{ii}^T)^2}{[\lambda_i+(1-\lambda_i)p_{ii}^T]^2} - \frac{n_i^0 - n_i}{(1-\lambda_i)^2}$$

$$\frac{\partial^2 \ln L_i}{\partial p_{ij} \partial p_{ij}} = -\frac{n_{ij}}{(p_{ij})^2} \tag{11}$$

$$\frac{\partial^2 \ln L_i}{\partial p_{ii} \partial p_{ii}} = \frac{(T-1)Tn_i(1-\lambda_i)p_{ii}^{T-2}[\lambda_i+(1-\lambda_i)p_{ii}^T] - n_i[T(1-\lambda_i)p_{ii}^{T-1}]^2}{[\lambda_i+(1-\lambda_i)p_{ii}^T]^2} - \frac{n_{ii}-Tn_i}{(p_{ii})^2}$$

The relative parameter values fed into (11), reciprocal and then negative, we can get the asymptotic standard error.

Define:

$$\Lambda = \frac{\sup\limits_{p,\lambda\neq 0} L(P,\theta)}{\sup\limits_{p,\lambda=0} L(P,\theta)} = \frac{L(\hat{P},\hat{\theta})}{L(P,0)} \ , \tag{12}$$

Which $p = \| \frac{n_{ij}}{n_i^*} \|$. The numerator and denominator can be expressed as:

$$L(\hat{P},\hat{\theta}) = \prod_{i=1}^{k} \{ (\frac{n_i}{n})^{n_i} (\frac{n_i^0 - n_i}{n})^{n_i^0 - n_i} [\lambda_i + (1-\lambda_i)p_{ii}^T]^{n_i} (1-\lambda_i)^{n_i^0 - n_i} \hat{p}_{ii}^{n_{ii}-Tn_i} \} \prod_{i \neq j} \hat{p}_{ij}^{n_{ij}}$$

$$L(P,0) = \prod_{i=1}^{k} (\frac{n_i^0}{n})^{n_i^0} \prod_{i,j} (\frac{n_{ij}}{n_i^*})^{n_{ij}} \ ,(13)$$

If the hypothesis (λ_i=0) is true, then -2lnΛ progressive degrees of freedom k chi square distribution. If the value does not exceed the critical value of party chi distribution, which the Markov chain general enough to describe, or that the "mover- stayer" model is more suitable.

2. DATA DESCRIPTION

This paper selects data (2007-2013 from wind database) for empirical analysis; select the average rate of return, Sharp index and Treynor index of performance evaluation indicators, the duration is 1 year. The Sharp index refers to the unit risk can give excess return, Sharp index is larger, the fund unit risk returns are higher, the better the performance of; Treynor index is based on system risk of fund income as a factor of fund performance adjustment, reflecting the unit commitment risk fund system gains the index value, the index is larger, bear the risk unit system gains the higher value.

Firstly, the performances of the fund in China during the sample period are described as shown in Table 1.:

Table 1
Sample Funds Statistical Description

The year	2008	2009	2010	2011	2012
The number of funds	124	163	215	266	322
Average rate of return (%)	-14.78	13.87	-0.93	2.13	-4.01
Sharpe index	-0.12	0.09	-0.01	0.00	-0.04
Treynor index	-2.30	0.59	0.02	0.03	-0.29

The fund will be divided into 5 groups as *A, A-, B, C, C-*(k=5), and tested the difference of each performance, as follows:

Table 2
Each Fund Performance for the Significant Differences Test in Initial Stage

		A	*A-*	*B*	*C*	*C-*	*F* statistics
Three years period (215 funds)	Average rate of return (%)	3.30	0.60	-1.10	-2.70	-5.61	111.76(0.0000**)
	Sharpe index	0.02	-0.01	-0.02	-0.03	-0.05	93.41(0.0000**)
	Treynor index	0.21	-0.01	-0.06	-0.10	-0.21	22.84(0.0000**)
Four years period (163 funds)	Average rate of return (%)	8.44	4.45	2.49	0.80	-3.83	41.07(0.0000**)
	Sharpe index	0.06	0.02	0.00	-0.01	-0.04	33.06(0.0000**)
	Treynor index	0.41	0.15	0.06	0.01	-0.15	30.01(0.0000**)
Five years period (124 funds)	Average rate of return (%)	4.35	0.63	-1.14	-2.80	-6.43	23.18(0.0000**)
	Sharpe index	0.02	-0.01	-0.02	-0.03	-0.08	21.38(0.0000**)
	Treynor index	0.22	-0.02	-0.07	-0.13	-2.06	6.24(0.0000**)

Note. The value in brackets is *P* value for testing.

As can be seen from Table 2, according to the different target groups, the performance data for a period of 3-5 years of each fund has significant differences, and provide a theoretical basis for calculating the transition probability of each fund performance groups.

3. EMPIRICAL ANALYSIS

Table 3
The Number of Move Fund and Stay Fund in Different Term (3 Year)

	n_{ij}					n_i^0	n_i	n_i^*
Average rate of return (%)	14	18	15	18	21	43	0	80
	20	13	19	15	19	43	1	79
	15	16	23	23	9	43	2	75
	17	20	18	15	16	43	1	80
	20	19	11	15	21	43	2	76
Sharpe index	24	13	17	18	14	43	7	73
	21	12	16	17	20	43	2	79
	17	22	14	13	20	43	1	78
	11	14	23	18	20	43	4	78
	13	25	16	20	12	43	1	82
Treynor index	19	19	19	12	17	43	3	78
	19	19	14	17	17	43	2	75
	13	19	19	18	17	43	1	78
	16	14	22	15	19	43	1	78
	19	15	12	24	16	43	0	76

Table 4
Estimation of Model Parameters (3 Years)

	p_{ij}					λ_i	-2lnΛ
	0.2164**	0.1959**	0.1633**	0.1959**	0.2286**	0	
	(0.0039)	(0.0031)	(0.0029)	(0.0031)	(0.0034)	（0.0104）	
	0.2333**	0.1485**	0.2216**	0.1750**	0.2216**	0	
	(0.0036)	(0.0028)	(0.0035)	(0.0031)	(0.0035)	（0.0015）	
Average rate of return (%)	0.1511**	0.1612**	0.3654**	0.2317**	0.0907**	0	141.4325**
	(0.0027)	(0.0027)	(0.0052)	(0.0033)	(0.0021)	（0.0061）	
	0.1956**	0.2301**	0.2071**	0.1830**	0.1841**	0	
	(0.0032)	(0.0035)	(0.0033)	(0.0032)	(0.0031)	（0.0023）	
	0.2232**	0.2121**	0.1228**	0.1674**	0.2746**	0.0016	
	(0.0034)	(0.0033)	(0.0025)	(0.0029)	(0.0041)	（0.0038）	
	0.0539**	0.1984**	0.2594**	0.2747**	0.2136**	0.1604**	
	(0.0012)	(0.0038)	(0.0043)	(0.0044)	(0.0039)	（0.0039）	
	0.2593**	0.0864**	0.1975**	0.2099**	0.2469**	0.0393	
	(0.0039)	(0.0021)	(0.0034)	(0.0035)	(0.0038)	（0.0022）	
Sharpe index	0.1958**	0.2534**	0.1707**	0.1497**	0.2304**	0	183.0777**
	(0.0032)	(0.0037)	(0.0031)	(0.0028)	(0.0035)	（0.002）	
	0.1463**	0.1862**	0.3060**	0.0954**	0.2661**	0.0847**	
	(0.0030)	(0.0034)	(0.0044)	(0.0021)	(0.0041)	（0.003）	
	0.1533**	0.2949**	0.1887**	0.2359**	0.1271**	0	
	(0.0029)	(0.0040)	(0.0032)	(0.0036)	(0.0025)	（0.0011）	
	0.1632**	0.2373**	0.2373**	0.1499**	0.2123**	0.0143	
	(0.0030)	(0.0037)	(0.0037)	(0.0030)	(0.0035)	（0.0016）	
	0.2178**	0.2319**	0.1605**	0.1949**	0.1949**	0.0089	
	(0.0034)	(0.0038)	(0.0029)	(0.0032)	(0.0032)	（0.003）	
Treynor index	0.1383**	0.2021**	0.2873**	0.1915**	0.1808**	0.0042	158.8758**
	(0.0026)	(0.0032)	(0.0045)	(0.0031)	(0.0030)	（0.0055）	
	0.1824**	0.1596**	0.2508**	0.1906**	0.2166**	0	
	(0.0031)	(0.0029)	(0.0036)	(0.0034)	(0.0034)	（0.0025）	
	0.1971**	0.1556**	0.1245**	0.2489**	0.2740**	0	
	(0.0031)	(0.0027)	(0.0025)	(0.0035)	(0.0047)	（0.0104）	

Note. The parenthesis is standard errors, * * *, * *, and * represent respectively in 1%, 5% and 10% of the significance levels significantly.

In this paper, a period of three years is as an example to illustrate how to estimate the relevant parameters of “mover-stayer” model. First of all, the 2010 annual funds were divided into five groups according to the performance (k=5), the number of each group funds were roughly the same, then calculate the number of 2011 annual move funds n_{ij} and stay funds n_{ii}; the process is applied to 2012 degrees, so as to obtain the number of eventually move funds and stay funds , as described in Table 3.

The paper first analyzes the fund performance persistence of three-year observation period, as shown in Table 4: Assume that the fund's performance is not persistent, then, the transition probability between the 5 groups of fund should be close to each other, and namely the probability transfer to each group is about 0.2. From the transition probability matrix of moving fund, the Value is not great for diagonal entry p_{ii}. The maximum is B fund which is divided based on the average rate of return, p_{33}=0.37, but when divided by the index of Sharpe, p_{33}=0.20. This means that the fund has Short-Run Persistence in moving funds group, but not intensive. And if funds performance evaluation index is different, the persistent conclusion is also different.

To observe the move fund which has better performance in initial stage for three years, we can see that the retention probability is smaller, the biggest among them is "A" group move funds which was divided by Treynor index, and its retention probability is 0.23. On the whole, the initial better move fund has reversal phenomenon generally. And the highest variable probability of later performance would attain 0.71, the minimum is 0.55.

To observe move fund of medium performance in initial stage, its highest variable probability of later performance that getting worse can reach 0.40 and the minimum is 0.32. This means this fund has a strong performance desire, but can not succeed. Overall the performance will be improved.

The retention probability of poor-performance fund in initial stage is up to 0.27 in this group, it can be seen that the fund group which has poorer performance has a relatively high Short-Run Persistence.

To observe the residence ratio of fund performance, the highest is "A+" group funds based on Sharpe index, the residence ratio can reach 0.16, and the poor performance of the funds' residence ratio is also relatively larger, up to a maximum of 0.09. In addition, moderately funds' residence ratio is significantly to 0 except the ratio 0.04 based on Treynor index, that means the moderately funds has a strong change desire, its performance will be changed in the later, but not necessarily be better.

To observe the "mover - stayer" model's test statistic $-2\ln\Lambda$, in the 0.05 test level, each statistic is greater than the critical value of 11.07, which means that mover - stayer model is feasible to describe China's funds' performance variation.

Using the same method to analysis the funds for a period of 4 years and 5 years, we found that the probability of the poor performance of the funds transferred to its group based on yield index were 0.33, 0.32. In addition, if the performance of the funds were better at the beginning, the performance's probability of funds that became worse was up to 0.63, the lowest was 0.53, which means with the extension of the study period, the funds that initial performance better has certain degree of persistence. Overall, compared with the funds that have poor performance, the persistent is disease. And the longer the period, the retention ratio decreased In general, and prove that the fund performance persistence is short.

CONCLUSION

In this paper, we selected the fund data from 2007 to 2013, and selected the average fund returns, Sharpe index, Treynor index as the index to study China's performance persistence based on "mover - stayer" model. We found that our funds' performance has short-term persistence, but weaker intensity. With the extended period, the residence probability of moving fund has increased, but the retention ratio decreased.

In the specific analysis of move funds' transfer probability, it was found that the initial performance of the fund that better than another has a weak sustainability; initial medium performance of the fund has the weakest persistence, most of its performance has the reversal phenomenon; the poor performance of the fund at the beginning has the averagely most high residence probability, namely has a relatively strong persistence. Overall, the fund performance in China has weak persistence through our empirical analysis.

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