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Chinese Mutual Funds Performance using 4-factor Fama-French Model, Sortino and Sharpe Ratios

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Abstract: This paper examined the performance of the Chinese Mutual funds using the Sharpe ratio, Sortino ration and the 4-factor Fama and French model to assess the price of the mutual funds. A sample of 221 months was used (January 2003-July 2020). The results showed the MOM had the highest return with relatively lower volatility. The mutual funds; however, were found to have a lower Sharpe, and Sortino ratios an indication that they are less attractive. The 4-factor model show statistically significant coefficients, an indication that the additional three factors in the CAPM model contributes to the exploration of the asset prices.

Keywords: Mutual funds, Sortino, Sharpe, 4-factor model

1. Introduction

The fundamental premise of investment is that the return and risks of a financial asset should be consistent. Stock return analysis has long been a hot topic in the investment sector, and as a result, it has been dubbed the most important area of financial economics [1]. However, in a volatile investment climate, measuring expected returns and risk is a practical difficulty for all investors. A number of asset pricing models are attempting to address the factors that influence asset values and help investors through the decision-making process. In this research, the 3-factor Fama-French model, Sortino, and Sharpe ratios are used to assess the performance of Chinese mutual funds from 2003 to 2020.

The sustained development of the Chinese stock market coupled with increase in the household wealth has called for increased investment in mutual funds. A significant amount has been invested in the Chinese stock market as the country emulate the developed economies. The mutual funds have become an attractive investment for both institutional and individual investors. A survey by Galaxy Securities, about 83% of the participants (sample size = 14,800) chose mutual fund as their first investment in the financial market [2]. The number of mutual funds in the Chines securities market have seen a huge growth from inception in 1998. Currently the number of funds exceed 1110 with net value of about 438 billion US dollars (2.7 trillion Chinese Yuan). The open-end equity mutual funds forms more than 90% of these funds [2].

Mutual fund performance has been extensively studied in developed markets, with studies such as Chen and Huang [3], Cuthbertson, Nitzsche and O'Sullivan [4], Vidal-Garcca, Vidal and Boubaker [5], Yasir Khan et al. [6]. Despite the huge volume of literature on mutual funds perfoemance very few studies have concentrated on China and other developing countries.

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Dritsakis, Grose and Kalyvas [7] investigate Greek funds, while Białkowski and Otten [8] investigate Polish funds. Abramov, Akshentceva and Radygin [9] conduct research on Russian funds. Brau and Rodríguez [10] investigate USA and Mexico mutual funds. Aside from the lack of literature in Chinese mutual funds, the rapid growth of the Chinese mutual fund market necessitates a systematic investigation of fund performance. The objective is this paper is to explore the performance of Chinese mutual funds using historical data.

2. Data and Methodology

2.1. Data

The data was collected from the WIND database (www.wind.com.cn). The WIND is the most reliable source of Chinese financial markets data. The dataset ranges from January 2003 to July 2020 spanning 17 years and 7 months. The total observations are 211. The period was selected since there were few listed companies to ensure enough mutual funds before 2003 [11]. Description of the variables used in this analysis are presented in Appendix A. A total of 1181 stocks were available for the entire period selected.

Appendix A: Variable Description.

Variable	Description
Return(r)	Is the monthly fund return denoted as r
Risk free rate	Risk free rate of return denoted as r_f
Market rate	Market rate of return denoted as r_m
SMB	The size effect based on the market capitalization of a company (Small minus Big)
HML	The spread in returns between companies with a high book-to-market value ratio and companies with a low book-to-market value ratio (High minus Low)
MOM	The difference between the equal weighted average of the highest performing firms and the equal weighed average of the lowest performing firms, lagged one month

2.2. The 3-Factor Model

Factor models belong to a group statistical models that strive to explain complex phenomena using relatively small number of underlying causes or variables. The first widely known asset pricing model is the *Capital Asset Pricing Model (CAPM)* developed by Sharpe (1964) and Linter (1965). The model uses only one variable to describe the returns on a portfolio or stock. However, the advancement in computing power, Fama and French expanded the model to include multiple factors. The two made an observation that two classes of stocks have tended to perform better than the whole market. These include (1) small caps, and (ii) stocks with high book-to-market ratio. Additionally, the difference between the equal weighted average of the highest performing firms

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and the equal weighed average of the lowest performing firms, lagged one month plays a role in the risk free return of an asset (MOM). The model is represented by the equation:

$$R_i - R_f = \alpha + \beta(R_m - R_f) + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \beta_{MOM}MOM_t \quad (1)$$

Where:

R_i − The expected portfolio return. In this analysis the return on the mutual funds.

In estimating the model multiple linear regression was used. The results of the estimated model are presented in appendix[x].

2.3. The Sharpe Ratio

The ratio compares the expected return of an investment with the risk it carries. It shows that prolonged excess returns may indicate a more volatility and risk as opposed investing skill. This method was introduced by Economist William F. Sharpe in 1966. The ratio was calculated using the formula:

$$Sharpe\ ratio = \frac{E[R_i - R_f]}{standard\ deviation\ of\ the\ asset\ excess\ return} \quad (2)$$

Annualized ratio for each portfolio are presented in appendix [].

2.4. The Sortino Ratio

The ratio is mainly used in assessing the performance of an investment for every unit of downside risk involved in the deal. The downside risk is estimated based on the loss a portfolio is expected to record due to market fluctuations. Additionally, the ration assist in determining marginal returns that the investor might generate for each downside risk in the market. The ration was calculated using the formula:

$$Sortino\ Ratio = \frac{Actual\ or\ Expected\ Returns\ on\ Investment - Risk\ free\ rate}{Downside\ Risk\ Standard\ Deviation} \quad (3)$$

Annualized and yearly (2003-2020) ratios are presented in appendix [].

3. Analysis and Discussions

3.1. Summary Statistics for the Portfolios

The summary statistics for the variables are presented in Table 1. The statistics include sample size, mean, standard deviation, minimum, quantile distributions and maximum. The mean monthly return for the funds is 1.43% (SD = 6.73%), the highest loss that has been recorded is 24.39% and the highest gain is 19.54% in a month. The mean monthly return for the SMB is 0.66% (SD = 7.89%), the highest loss that has been recorded is 26.50% and the highest gain is 22.27% in a month. The volatility of SMB is higher than that of the mutual funds combined. Next, the mean monthly return for the HML is 0.57% (SD = 5.34%). However, it had recorded a maximum loss of 22.50% and largest return of 21.38% in a month. The asset performs relatively worse than the SBM and mutual funds but it has the lowest risk. Finally, the mean for MOM is 0.07% (SD = 3.34%) with worst loss of 15.51% and highest return of 16.38%. Out of the four portfolios the mutual fund tends to perform better.

In this table, we show summary statistics for key variables used in our study. Detailed variable definitions are provided in Appendix A. For each variable, “N” represents the number of observations; “Mean” represents the equal-weighted mean value; “SD” represents its standard

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deviation; “Min” (“Max”) represents minimum (maximum) value; “Median” represents the median value; and “Pxx” represents the xxth percentile of its distribution.

Table 1: Descriptive statistics.

	N	Mean	SD	Min	P25	Median	P75	Max
Return(r)	221	1.43	6.73	-24.39	-2.22	1.96	4.80	19.54
Risk free rate	221	0.16	0.06	0.09	0.09	0.14	0.22	0.28
Market rate	221	0.81	7.89	-26.24	-3.53	1.06	4.82	22.44
SMB	221	0.66	7.89	-26.50	-3.71	0.87	4.64	22.27
HML	221	0.57	5.34	-22.50	-2.54	0.43	3.89	21.38
MOM	221	0.07	3.34	-15.51	-1.62	0.12	1.55	16.38

Note: The values are in percentages (%)

3.2. The Sharpe and Sortino Ratio

The MOM performs better than all the other portfolios since it has a Sharpe ration of greater than 100%. The MOM would offer excess returns relative to the risks. The HML portfolio has a negative Sharpe ratio implying that it offers losses associated with the high risk presented by volatility in table 1. Further, the SMB performs better than the market free rate asset. Similarly, from table 2, MOM has the largest annual return and a higher Sortino ratio implying that an investor would use the MOM stock to make decision in the Chinese Mutual funds market. Market free rate asset recorded the largest drawdown in the period 2003 to 2020. Additionally, table 3 shows that major fluctuation in the ration during the COVID-19 period (2020) and that this affected MOM positively while it affected the other indices negatively. The yearly Sortino ration for the index seems to follow a random pattern.

The table present annualized average return, standard deviation, Sharpe, Sortino ratio and maximum drawdown during the sample period.

Table 2: Annualized ratios.

Index	Returns	Standard deviation	Sharpe	Sortino	Max Drawdowns
Rm-Rf	7.87	94.72	75.51	29.74	-72.26
SMB	6.9	64.03	93.69	36.12	-42.39
HML	0.9	40.07	-30.05	-8.34	-37.74
MOM	8.15	61.98	120.87	47.07	-46.07

Note: The values are in percentages (%)

The table present yearly Sortino ratios for the funds and the measures.

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Table 3: Yearly sortino ratio.

Year	SMB	HML	MOM	rm-rf
2003	-30.05	191.81	277.88	-2.26
2004	-2.3	77.67	17.89	-15.47
2005	-18.17	45.83	13.12	-26.22
2006	-16.34	-12.56	50.29	53.99
2007	31.53	-0.81	-26.93	148.73
2008	34.19	-2.06	-23.61	-46.09
2009	46.33	-32.49	-50.06	69.6
2010	166.36	-31.45	32.43	-26.96
2011	-18.49	16.23	13.72	-52.94
2012	-3.31	-12.19	-12.7	-4.05
2013	69.86	-5.96	24.5	-35.35
2014	0.64	33.03	-28.04	57.71
2015	70.96	-46.23	-14.67	11.93
2016	34.79	27.87	-51.02	-27.9
2017	-32.9	33.93	42.81	34.84
2018	-32.11	23.05	12.96	-47.41
2019	-20.06	-34.23	11.83	84.55
2020	79.01	-63.94	2378.03	45.99

Note: The values are in percentages (%)

3.3. The 3-factor Model

From table 4, the estimated 4-factor model is

$$R_i - R_f 0.0058 + 0.7598\left(R_m - R_f\right) + 0.0697SMB_t - 0.4074HML_t + 0.264MOM_t \quad (4)$$

The estimated coefficients are all statistically significant at 5% level of significance. The model's estimates support the results presented by the Sortino, and the Sharpe rations. MOM explains a significant amount of changes in the expected return of a portfolio. Therefore, an investor who accord MOM significant attention would end up beating the market. Therefore, MOM, SMB and HLM are good predictors of the Chinese mutual funds' performance. The 4-factor model explains about 89.8% of the changes in the mutual funds expected returns. The amount of variance left for chance is less than 12%.

Table 4: The OLS estimate of the 4-factor model.

Variable	Estimate	Std. Error	t-statistic	P-value
constant	0.0058	0.002	3.784	<.0001
$r_m - r_f$	0.7598	0.019	39.543	<.0001
SMB	0.0697	0.035	1.99	0.048
HML	-0.4074	0.054	-7.521	<.0001
MOM	0.2644	0.031	8.655	<.0001

$R^2 = 0.898, F(4, 206) = 453.3, p < .0001$

The tables presents summary statistics for the table the estimated 4-factor model.

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4. Conclusions

The analysis showed a variation in the Sharpe ratio and Sortino ratios depending on the index used. In summary, the MOM index tend to provide significant information concerning the performance of the Chinese Mutual funds. Additionally, the Sortino ration appears to have a random patter in each year. The conclusion would be take note of changes in the MOM and SMB when investing in Chinese Mutual funds. A positive change in the MOM should translate to positive return on the mutual funds.

References

[1] *Lian, X., Liu, Y., & Shi, C. (2021). A Composite Four-Factor Model in China. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3928587*

[2] *Rao, Z.-R., Ahsan, T., Tauni, M. Z., & Umar, M. (2017). Performance and Persistence in Performance of Actively Managed Chinese Equity Funds. Journal of Quantitative Economics, 16(3), 727–747. https://doi.org/10.1007/s40953-017-0104-5*

[3] *Chen, C. R., & Huang, Y. (2011). Mutual Fund Governance and Performance: A Quantile Regression Analysis of Morningstar's Stewardship Grade. Corporate Governance: An International Review, 19(4), 311–333. https://doi.org/10.1111/j.1467-8683.2011.00858.x*

[4] *Cuthbertson, K., Nitzsche, D., & O'Sullivan, N. (2010). False Discoveries in UK Mutual Fund Performance. European Financial Management, 18(3), 444–463. https://doi.org/10.1111/j.1468-036x.2009.00536.x*

[5] *Vidal-Garcca, J., Vidal, M., & Boubaker, S. (2016). A Comparison of Short-Term Persistence of Mutual Fund Performance in Europe. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2746254*

[6] *Yasir Khan, Saima Batool, Mukharif Shah, & Mukharif Shah. (2021). Mutual Fund Performance Persistence and Competition: Pakistan's Open Ended Mutual Fund Performance Analysis. Journal of Business & Tourism, 5(2), 165–176. https://doi.org/10.34260/jbt.v5i2.148*

[7] *Dritsakis, N., Grose, C., & Kalyvas, L. (2006). Performance aspects of Greek bond mutual funds. International Review of Financial Analysis, 15(2), 189–202. https://doi.org/10.1016/j.irfa.2005.10.001*

[8] *Białkowski, J., & Otten, R. (2011). Emerging market mutual fund performance: Evidence for Poland. The North American Journal of Economics and Finance, 22(2), 118–130. https://doi.org/10.1016/j.najef.2010.11.001*

[9] *Abramov, A., Akshentceva, K., & Radygin, A. (2015). Mutual Funds Performance in Russia. Economic Policy (in Russian), 60–86. https://doi.org/10.18288/1994-5124-2015-4-04*

[10] *Brau, J. C., & Rodríguez, J. (2009). An empirical analysis of Mexican and US closed-end mutual fund IPOs. Research in International Business and Finance, 23(1), 1–17. https://doi.org/10.1016/j.ribaf.2008.03.001*

[11] *Liu, J., Stambaugh, R. F., & Yuan, Y. (2019). Size and value in China.Journal of Financial Economics,134(1), 48-69. https://doi.org/10.1016/j.jfineco.2019.03.008*