CSCanada
International Business and Management
Vol. 9, No. 2, 2014, pp. 145-153
DOI:10.3968/6051

ISSN 1923-841X [Print]
ISSN 1923-8428 [Online]
www.cscanada.net
www.cscanada.org

The Relationship Between UK Domiciled Funds Size and Performance

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Supported by the Fundamental Research Funds for the Central Universities (SWU 1409319)

Received 9 August 2014; accepted 6 October 2014
Published online 30 November 2014

Abstract

The on-going debate on the relationship between fund asset size and performance has been inconclusive. The previous studies made different conclusions. Researchers like Zera and Madura (2001) and Latzko (1999) concluded the positive relation between fund size and performance while Perold and Salomon (1991), Chen et al. (2004) and Yan (2008) thought the relation is negative, meanwhile Clark (2003), Gregoriou and Rouah (2003) thought that there is no significant relationship between fund size and performance. Most of the literatures studied about US mutual fund and hedge fund and the literature failed to examine the UK domiciled fund, an important kind of fund which includes about 10,000 fund. By applying both logarithm linear and quadratic regression model for each measurement of fund performance, the results revealed that the fund return is positive related to its performance while fund's standard deviation, Sharpe ratio and Treynor ratio are all significantly negative related to the fund performance. And the relation between fund alpha and performance is statistically insignificant.

Key words: Fund size; Performance; UK domiciled fund; Regression

Kong, X. T. (2014). The Relationship Between UK Domiciled Funds Size and Performance. *International Business and Management, 9*(2), 145-153. Available from: http://www.cscanada.net/index.php/ibm/article/view/6051
DOI: http://dx.doi.org/10.3968/6051

INTRODUCTION

While fund performances are effected on some factors of fund, among those factors, the fund size is widely regarded as a significant problem in the mutual fund managements. In spite of the increasing popularity of mutual fund, Saunders-Egodigwe and Franecki (1998) reported that, in the year of 1998, mutual fund closed doors to new investors. This event and the Magellan's example cause the question about whether fund performance has an inverse influence due to the increasing of fund asset size. Therefore, the debate about how fund asset size impacted on fund performances has been argued for decades.

The relationship between fund performance and asset size has been debated for a decade, however, there is still no clear-cut result that the relationship is sometimes found to be negative, positive or even no correlation.

(1) A Negative Relationship Between Funds Size and Performance

A lot of authors concluded a negative relationship between fund's size and performances that mean the performance of funds would be poor with the increasing of the size.

Edwards and Caglayan (2001) explored the hedge fund performance increase as a decreasing rate of fund size increasing by applying six factors model which regressed on five variable: fund size, the logarithm of size which is used to clearly point out the relationship, the age of fund and both incentive and management fees. The result with a positive coefficient of the fund size together with a negative coefficient of the logarithmic size revealed that hedge fund performance rises at a decreasing rate as the fund size increasing.

Keim, Christoffersen and Musto (2007) researched on mutual funds in the Canadian market where all tradings should be reported. They measured excess return as the difference of the size-weighted average return with a fund net return. They found that the large scale fund earned

lower return than funds with small asset size. However, there is a restriction of this finding that the fund they analyzed were generally smaller than many American mutual funds.

In order to investigate how the essentially of the economies of scale throughout the various investment styles, Yan (2008) divided all funds into deciles according to the average book-to-market value of their stockholding and the turnover rate. Yan (2008) regressed alpha on different variables, including annualized return and fund asset size. Yan found a positive relationship between annualized return and alpha and a positive relation between fund asset size and alpha. Hence, Yan found that, alpha for large scale funds is averagely smaller while the annualized return is predictable linked to higher alpha. Concur with the assumption that liquidity is one of main reasons of erosion of performance by fund size, Yan revealed that adverse impact of fund size on performance is much more significant among two kind of funds, one is the fund with low book-to-market value, another is the fund with high turnover rate. This point of view followed Keim and Madhavan (1997) and Chan and Lakonishok (1995) who found that the investment style of fund pronouncedly affect the trading cost: fund mangers who require a higher instantaneity might be connected with more expanse of trading and larger market influence. Particularly, Chan and Lakonishok (1995) concluded that trading expenses are higher for funds with increasing turnover rate.

(2) A Positive Relationship Between Funds Size and Performance

In contrast, some other researchers discovered the positive relationship between fund asset size and performance which implies the performance would be better since the greater size is desirable.

Brown, Goetzmann and Ibbotson (1999), Ackermann, McEnally and Ravenscraft (1999) have documented a positive relation between performance and incentive fee, thus there is a diseconomy of scale due to the large transaction costs. These literatures used the percentage incentive fee charged by the hedge funds to represent managerial incentives, however, it seems less reasonable due to the complex structure of hedge funds. By modeling the incentive-fee-contract as a portfolio of call options with different strike prices, Agarwal, Daniel and Naik (2004) overcome the limitations of previous studies and point out the negative relation between size and performance and the larger the hedge fund size, the poor the performance would be.

Liang (1999) also the positive relation by investigating the impact of fund characteristics with cross sectional regressions. Liang analyzed a data which contained 4776 mutual funds and 385 hedge funds from 1994 to 1996. The result revealed that more successful hedge funds are able to absorb more investment and therefore positively associated with their former performance.

Zera and Madura (2001) found a statistically significant negative relation between fund costs and both individual fund scale and fund family asset size that funds with larger scale are usually with less expense percentage. This significant relation implied that increasing the fund asset size is worthwhile. Moreover, Zera and Madura also found that the elasticity of fund costs with regard to the fund asset size cannot differ among different fund size calorifications which implied the response of fund sponsor earnings to changes of fund scale correspond with proportion term among different fund size classifications. This point has also been studied by Latzko (1999). Latzko focused on the economies of scale in mutual fund by considering three major categories of mutual fund expenses: management fee, 12b-1 distribution fee (An annual marketing or distribution fee on a mutual fund. The 12b-1 fee is considered an operational expense and, as such, is included in a fund's expense ratio. It is generally between 0.25-1% of a fund's net assets) and other administrative expenses. By using a translog function of costs with average approach, Latzko found the fund asset coefficient and the mean expenses curve for a representative mutual fund is descending sloped across the complete fund asset

(3) No Significantly Correlation Between Funds Size and Performance

Furthermore, some authors found that there is no significantly correlation between fund size and performance.

Clark (2003) provided a compositive research about the relation between fund asset size and performance for mutual fund. By using mean return and risk-adjusted return, Clark concluded that there is no distinct relationship between the return of funds and asset size. Gregoriou and Rouah (2003) obtained the similar conclusion as Clark (2003) while they focused on Hedge funds. The relation is verified with correlation coefficient and the rank correlation. As different as Clark, Gregoriou and Rouah (2003) analyzed 204 hedge funds during the time period from 1994 to 1999 by using the Sharpe ratio, the geometric mean and the Treynor ratio, and found that the correlations of the above variables are not mathematically significant.

Different from above studies, Ding et al. (2009) obtained two results by using different performance measures. According to the result of the mean coefficient estimation for different kind of fund strategies, the estimated size coefficient is averagely negative for fund strategies but this negative relationship between fund scale and performances only obviously for the subgroup of hedge fund not the whole industry.

1. METHODOLOGY

To study the impact of the UK Domiciled Funds size on fund performance, I collect data from Morningstar. The sample includes 500 UK domiciled funds in the period from 2011 to 2013. We select this period as the sample period for this study as following reasons.

There are two main reasons for choosing sample after 2011. Firstly, because fund operated less than 3 years would not be rated by Morningstar, mutual funds in this sample are all operated in 3 years, thus, this sample includes UK Domiciled Funds with at least one rating by Morningstar. Second, the reason that I choose to study UK Domiciled funds in this time period is that those funds show in Morningstar with the impact of incubation bias (Evans, 2010) on the result. While incubation bias may be helpful to illustrate the reason of why fund showing in Morningstar at the first time usually appears with average Morningstar ratings about a 1/4 higher than older funds , this would follow Evans who analyzed the future inflow and performances by only applying non-backfilled sample. Therefore, the evaluation of the diseconomies of scale is ought to be uninfluenced by incubation bias. Thus, analyzing this time period will be appropriate to test the relation between fund performances and scales.

1.1 Main Variables

We obtained the following variables: Fund size, 3 years Annualized return, 3 years Alpha, 3 years Beta, 3 years Sharpe Ratio, 3 years standard deviation (Std Dev), Morningstar rating and Morningstar equity style box for each fund.

3 years annualized return is the rate of return you would expect to receive per year given a cumulative 3-year return after taking into account the effects of compounding. Annualized return considers the volatility. It is virtually the annual rate of return which only focuses on the value from beginning to the end, no matter what took place during the time period.

Alpha is a ratio which is the percentage of the excess return of one portfolio or fund over its expected return, or its required return, for its expectative risk which is estimated by the beta. Thus, alpha is decided by the fundamental value of the corporations including in the fund or portfolio contractedly with beta, which estimates the return of portfolio in virtue of its volatility. The Jensen alpha appraises in which degree can the manager's capability to deliver above the average risk-adjusted return explains the portfolio's rate of return. The higher the alpha, the better performance of the risk-adjusted return. A portfolio always with a negative extra return would show a negative alpha, while a portfolio with a consistently positive additional return would show a positive alpha.

Beta is a measurement of the sensitivity to market fluctuations of funds .The beta of entire market is defined as one. Morningstar computes beta by comparing the premium return of fund over the Treasury bills to the premium return of market over Treasury bills. Beta could be a useful tool while some of fund historical performances are able to be explicated by the whole market. Beta is typically suitable to estimate the risk of a composite portfolio which consists of different mutual funds.

Standard Deviation is a statistical measure of deviation about the average, illustrates how far and wide the mutual fund return could vary during a specific period of time. Investors usually make use of the standard deviation of historical fund performances in order to attempt to forecast the possible scope of returns that are most probably to be reached for a specific mutual fund. For funds with a high standard deviation, the forecast scope of performance is wide which indicates the greater volatility of this fund performance. The figure could not be connected to more than one fund for the standard deviation of one portfolio which contains various funds is a function of both the individual standard deviation and the level of correlation among various funds returns. Standard deviation is also a constituent in the Sharpe Ratio, which measures the risk-adjusted performance.

The Sharpe ratio is computed for the time period of the past 36 months by dividing the annualized excess return of fund reduce the risk-free rate of return by annualized standard deviation of this fund. It is computed as+

$$SR_i = \frac{E[R_{it}\text{-}rf_t]}{\sqrt{\text{Var}[R_{it}\text{-}rf_t]}}$$

where R_{it} is the return of percentile i at time t and $r\,f_t$ is the risk free rate of return at time t.

The upper half of the equation considering the return of specific fund over a particular amount of time and reduce the he risk-free rate (usually defined as the T-bills rate in the same period). The lower half is a measurement of volatility or the amount of deviation among the return of fund compared with the average performance. Thus, the higher the Sharpe ratio, the more the investor is paid due to the amount of risk that investors undertake. If Sharpe ratio is equal to one, it is regarded as good, while 2 is regarded as great and 3 is regarded as exceptional.

Each variable mentioned above are available from Morningstar. However, there is another measure of fund performance, the Treynor ratio which is unable to be obtained from Morningstar and needed to be calculated.

Treynor ratio is a measure of fund return obtained in additional of what could be earned based on a risk-free investment. Different from Sharpe ratio, Treynor ratio correlates the extra return over the risk-free rate to the excess risk undertaken; however, systematic risk is applied to replace the total risk. Furthermore, contrasted with Sharpe ratio, Treynor ratio applies beta in the denominator to replace the standard deviation which is in the denominator of Sharp ratio. The beta estimated only the sensitivity to the market fluctuant for a fund, while

the standard deviation measures the total volatility both downside as well as upside. If a fund has a higher Treynor ratio, this indicates that the investor obtained more profit for per unit of market risk. One of the main advantages of Treynor ratio is that it illustrates how fund would perform under no relation with its own volatility but the volatility it takes to the overall market.The function of Treynor ratio is as following.

$$TR_i = \frac{E[R_{it}\text{-}rf_t]}{\beta_i}$$

where R_{it} is the return of percentile i at time t and r f_t the risk free rate of return at time t.

Furthermore, because:

Sharpe ratio = (Portfolio Return – Risk-Free Rate)/ Standard Deviation

Treynor ratio = (Portfolio Return – Risk-Free Rate)/Beta

The Treynor ratio could be calculated as:

Treynor ratio = Sharpe ratio × Standard Deviation/Beta

Morningstar rates mutual fund share class range from one star (the lowest rating) to five stars (the highest rating). The rating of each mutual fund share class according to its associative performance in the Morningstar investment category over the pervious 3 years, 5 years, and 10 years, based on risk-adjusted basis and accounting for all the costs. Mutual fund share classes which are less than 3 years would not be rated by Morningstar.

Morningstar equity style box is a patent of Morningstar analysis system. The Morningstar use style box, a nine-square grid that provides a graphical representation of the "investment style" mutual funds, to reveal the investment core of funds. For equities and equity funds, it categorizes equities according to growth to value factors (the horizontal axis) and equity scale of fund (the vertical axis).

Morningstar Style Box ™

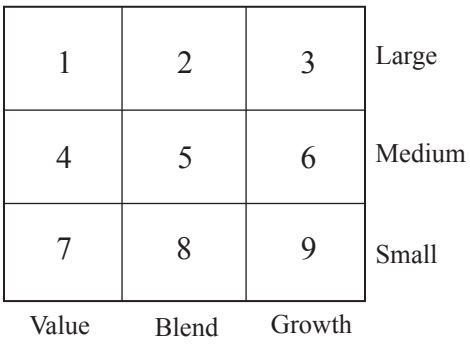

Figure 1
Morningstar Style Box

The vertical axis of the Style Box classifies three size groups, small, medium, and large according to the proportion of equity investment in the total fund. The horizontal axis categorizes as three style classifications. Two of these classifications, value and growth, are same for both equities and funds, but, for funds, the middle column of the style box represents as the blend style.

Value and growth characters for individual security are compared with those of other securities with the same size of capital and are figured from 0 to 100 for both growth and value categories. In order to calculate the overall style score, the score of value fund is reduced from the score of growth fund.

1.2 Analysis and Linear Regression Method

Morningstar investment style box is simple and intuitive to present the style of the fund's asset allocation, for the first time, investors would evaluate the fund according to the fund's portfolio but not the name of fund or financial corporations.

Table 1
Average Size and Return

Percentile	Average asset (million GBP)	Average return(%)
91st-100th	2766.96	7.63
81st-90th	709.83	6.77
71st-80th	397.05	7.81
61st-70th	250.16	10.07
51st-60th	187.59	9.55
41st-50th	131.69	8.23
31st-40th	82.91	7.01
21st-30th	52.83	6.28
11th-20th	27.61	4.88
1st-10th	8.34	3.35

To see whether there is a relation between mutual fund asset size and performances, the first step is to arrange mutual funds according to the size of their total net assets and group mutual funds into 100 percentiles with their corresponding average size and weighted average return (as Table 1 shows). Each percentile could be considered as one subsample.

From Table 1, we can observe that there is an average quadratic concave relationship between average size and average return in the database. This would suggest that there might be an optimal size with respect to performance. This analysis is deepened in the following sections in order to rigorously verify the statistical significance of this relationship.

In order to measure the return of unobservable hedge fund, the majority of pervious researches about performances of fund applied equally weighted returns. One reason why the majority of pervious researches have concentrated on equally weighted return might be the poor quality of sample of the fund assets under management. Since the quality of data has typically ameliorated in recent years, it is now workable to compute the asset weighted returns. In this paper, the asset weighted return of 500 data of UK domiciled funds are applied to measure fund performances.

The next step consists in determining whether there exist a relationship between fund performances and size is to linear regress each performance measures on the average percentile size. The regression is Perf Measure$_i$ = $\alpha + \beta\log(\text{assets}_i) + \varepsilon_i$

Results from the linear regression may not enable us to capture potential non-linearities in the relation between mutual fund sizes and performances. The possibility of nonlinear link between fund scales and performances has already been highlighted by Hedges (2004), Ammann and Moerth (2005), Getmansky (2004) and Xiong et al. (2009) in the hedge fund context. Consequently, next step is to use cross-sectional regressions to investigate whether there may also exist non-linearities in the relation of fund scales and performances. This could follow the same methodology as for the linear regression in terms of performance measures and percentiles. Instead of regressing percentile performance on the logarithm of average fund size under management only, followed the model of Bodson etc. (2011), I add the regression the square of the logarithm of average assets in the model:

Perf Measure$_i$ = $\alpha + \beta_1\log(\text{assets}_i) + \beta_2\log(\text{assets}_i)^2 + \varepsilon_i$

According to the function above, we can obtain the quadratic relationship between mutual fund size and each fund's performance. If the relationship between fund size and performance is concave, we can find that there exists an optimal asset size regarding of each performance which can maximize fund's performance. By doing cross-sectional regressions, we can obtain the coefficients of each variable (c, log (asset$_i$), log (asset$_i$)^2) which means that we can obtain the function of quadratic curve. Thus, it enables us to calculate the optimal fund size which maximizes the performance.

For a normal quadratic function y=ax^2+bx+c, then

y=a (x^2 + b/ax) + c

=a (x^2 + b/ax + (b/(2a))^2 - (b/(2a))^2) + c

=a (x + b/(2a))^2 - b^2/(4a) + c

=a (x + b/(2a))^2 + (4ac-b^2)/4a

Thus the coordinate of the max of a concave curve is: (-b/(2a), (4ac-b^2)/4a)

In this case, when the log (asset) equals to $-\beta_1/2\alpha$, there exits the maximize performance equals to $(4\beta_2\alpha-\beta_1{}^2)/4\beta_2$.

Therefore, log (asset) = $-\beta_1/2\alpha$, then Asset size=10^ ($-\beta_1/2\alpha$).

We can conclude that the optimal asset size for Performance is 10^($-\beta_1/2\alpha$).

On the other hand, if the relationship between fund size and performance is convex, optimum is a corner solution which means that , for funds with either large or small asset size, the fund are maximize performed. In this study, we could let the intermedial size for which performance is minimized.

Moreover, with the function of quadratic concave curve, there are two points where performance is equal to zero. Hence, it is possible to obtain the profitable range of fund asset size.

Mathematically, for a normal quadratic function y = ax^2 + bx + c, to obtain the zero performance point where y=0, then

a (x^2 + b/ax) + c =0

=> a (x^2 + b/ax + (b/(2a))^2 - (b/(2a))^2) + c = 0

=> a (x + b/(2a))^2 = b^2/(4a) - c

=> (x + b/(2a))^2 = b^2/4a^2 - c/a

=> x + b/(2a) = ± [√(b^2-4ac)]/(2a)

=> x = [-b ± √(b^2-4ac)]/(2a)

Same as the way to calculate optimal asset size, therefore,

Log (asset) = [-b ± √(b^2-4ac)]/(2a)

Thus, asset = 10^{[-b±√(b^2-4ac)]/(2a)}. And the profitable asset size is between 10^{[-b - √(b^2-4ac)]/(2a)} to 10^{[-b + √(b^2-4ac)]/(2a)}

Furthermore, in order to investigate the impact of each performance measurement on UK domiciled fund size across Morning Investment Styles, we could separate full sample in three sub-samples according to funds' style (value, blend or growth).The patterns of return where the sample is classified by investment style are same as the patterns for the overall sample. And then follow the two regressions above, linear regression and quadratic regression.

2. RESULTS

2.1 Fund Size and Annualized Return

Table 1 presents the deciles of fund asset size and the average annualized return of the UK domiciled funds in each decile. It is clearly to see that small funds at the bottom decile are underperformed. This circumstance could be illustrated by the economic scale effect. The administrative expenditure plays a significant role for funds with smaller scales and let it uneconomic to operate a fund with very small asset size. Funds from the 51st to the 70th percentile best performed. Those funds asset sizes are relatively intermediate with the fund size of less than 300 million GBP. A lot of institutional investors focus on funds with larger fund size and are consequently excluding funds with the highest rate of return according to the representation of fund scales. As is known that some of the largest scaled fund are shut for investment, therefore, a lot of investors are left with relatively small funds of a few hundred funds. Furthermore, funds below the 51st percentile presents a negative relation between fund asset scale and performances.

The relation between fund size and return is further investigated. Therefore, a simple regression analysis of the logarithm of the fund size is applied to the average return of the asset percentiles.

Table 2
Regression Result of Fund Size VS Annualized Return

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
Linear regression				
C	2.9132	1.1256	2.5882	0.0101
Log(assets)	1.8349	0.4989	3.6776	0.0003
R-squared	0.4039			
Adjusted R-squared	0.3294			
Quadratic regression				
C	- 0.0893	1.8430	- 0.0484	0.9614
Log(assets)	5.2894	1.7560	3.0121	0.0028
Log(assets)^2	- 0.8631	0.4209	- 2.0508	0.0412
R-squared	0.7402			
Adjusted R-squared	0.6660			

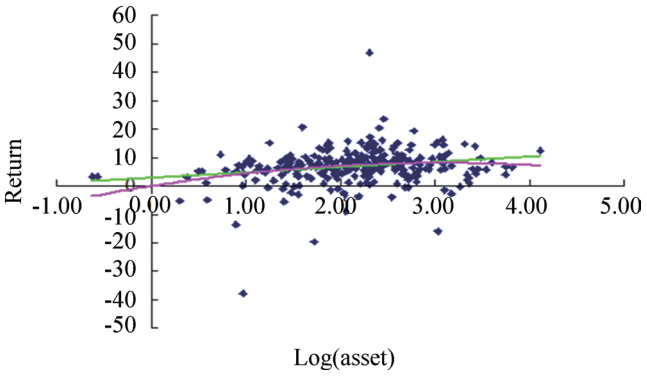

Figure 2
Log of Asset Size VS Annualized Return

The result of the linear regression is shown in Figure 2 and Table 2. Each data point in Figure 2 represents the 3 year annualized return for each fund in the sample. The linear relation between return and fund asset size is statistically positive significant at better than 1% significance level which means that the failure possibility of this result is 5%. Analyzing the scatter plot showing in Figure 2, it is clearly to see that the fund return is non-linear related to its asset size. By running a quadric regression, the concave relation is obviously, and it clearly verifies the result of Getmansky (2004). The concave curve in Figure 2 represents the result of the quadric regression. According to Table 2, the quadric term in this regression is significant at the 5% significance level which means that this result is correct at 95% level. Particularly, it is clear to see that very small funds which asset size is less than 20 million GBP are partly poor performed. Those findings stay with Ding et al (2009) that fund size is positively related to return to performance. Moreover, Ding et al. (2009) suggested that this relationship might only for subset of fund universe but not consequentially for the entire fund industry. The poor performance could be resulted in the large fund management expenses. Considering the minimum regular expenses for the administration of fund, fund management and conservation are the main constituent part of administration expenses which are decreasing the net return for investors.

2.2 Fund Size and Volatility

The influence of fund asset scales on the volatility is also investigated by running both linear and quadric regression. In this study, standard deviation (Std. Dev) is used to represent volatility because that standard deviation is a statistical measure that reveals the historical volatility. The findings have been summarized in Table 3 and Figure 3. According to Table 3, the linear regression of the relation between fund size and the volatility is a statistically significant at 1% significance level. The non-linear relation is also tested by running quadric regression which shows that the quadric term in the quadric regression is also significant at 10% significance level.

Table 3
Regression Result of Fund Size VS Standard Deviation

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
Linear regression				
C	15.0212	0.9877	15.2089	0
Log(assets)	- 1.2355	0.4378	- 2.8219	0.0051
R-squared	0.5446			
Adjusted R-squared	0.5408			
Quadratic regression				
C	16.7783	1.6236	10.3341	0
Log(assets)	- 3.25707	1.5469	- 2.1055	0.0361
Log(assets)^2	0.5051	0.3707	1.3624	0.1041
R-squared	0.7387			
Adjusted R-squared	0.7333			

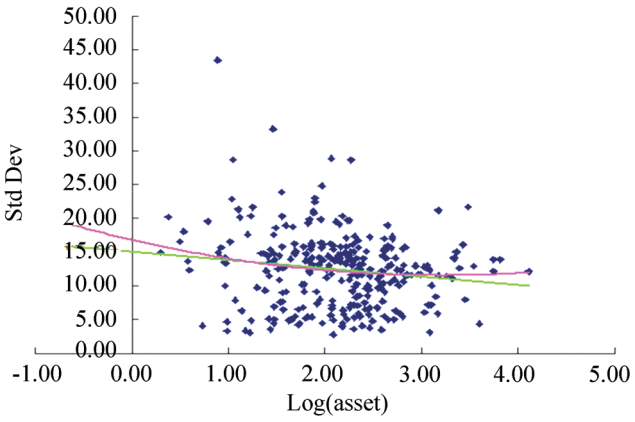

Figure 3
Log of Asset Size VS Standard Deviation

The relation between fund size and standard deviation is obvious, since large funds usually profit from a wider variation and with a decrement of volatility. Funds with large asset size are more able to attract investment due to the a historical fluctuation record, therefore, large funds

might shift their highlight on principal conservation (Ammann & Moerth, 2005). Moreover, large funds generally be in a good position to manage the fund asset better, and would obtain a sizable profit from a more fix earning. In order to administrate the fund asset flow, it is more easily for large scale funds to undertake less profitable liquidity circumstance, and therefore decreases the possibility of loss for investors. A steady asset investment could make a better plan of asset flows for investors. Therefore, a better condition for the manager to consistently achieve his investment strategy and also allows managers to invest in illiquid projects which are not daily priced and usually with less risk and stable profit, consequently minimize the volatility of funds.

3.3 Fund Size and Sharp Ratio

Moreover, the relation between fund asset scales and Sharpe ratio is investigated by applying a linear and a quadric regression approach separately. The results of the two regressions are summarized in Table 4 and Figure 4 as following. According to the linear regression, fund asset size is slightly statistically significant negative related to Sharpe ratio at better than 1% significance level. About the quadric regression, the quadric term is significant negative at better than 1% significance level. As can be seen from Figure 3, there is an obvious trend for the scatter plot shown as the curve. This result is opposite of Ammann and Moerth (2005) who found that the quadratic relation between fund asset size and Sharpe ratio is statistically significant but not obvious from scatter. According to the findings of the quadric regression, it is generally achievable to obtain an optimal fund asset size which maximizes the Sharpe ratio.

Table 4
Regression Results of Asset Size VS Sharpe Ratio

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
Linear regression				
C	0.9859	0.0782	12.6006	0
Log(assets)	-0.1402	0.0347	-4.0427	0.0001
R-squared	0.5988			
Adjusted R-squared	0.5486			
Quadratic regression				
C	0.6521	0.1267	5.1469	0
Log(assets)	0.2438	0.1207	2.0199	0.0443
Log(assets)^2	-0.0959	0.0289	-3.3167	0.001
R-squared	0.8520			
Adjusted R-squared	0.8098			

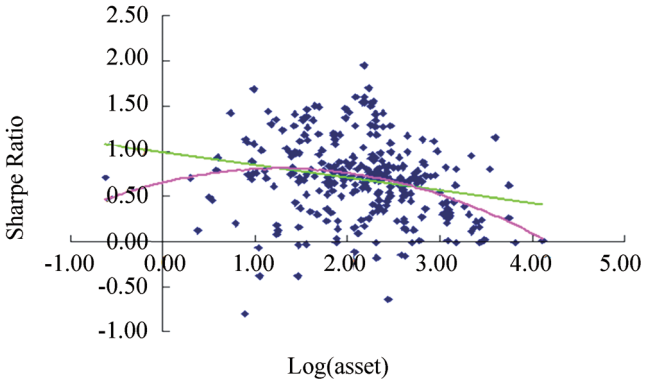

Figure 4
Log of Asset Size VS Sharpe Ratio

2.4 Fund Size and Alpha

The next is to explore the relation between alpha and the fund asset size. Figure 5 and Table 5 present the findings of both linear and non-linear regression. According to Table 5, the coefficient of Log (asset) in the linear regression is slightly negative and obviously not significant.

Table 5
Regression Results of Fund Size VS Alpha

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
Linear regression				
C	0.29061	0.6564	0.4427	0.6583
Log(assets)	- 0.0007	0.2909	- 0.0023	0.9982
R-squared	0.0008			
Adjusted R-squared	- 0.1241			
Quadratic regression				
C	- 0.5969	1.0805	- 0.5525	0.581
Log(assets)	1.0205	1.0295	0.9913	0.3224
Log(assets)^2	- 0.2551	0.2467	- 1.0341	0.3019
R-squared	0.0864			
Adjusted R-squared	- 0.1747			

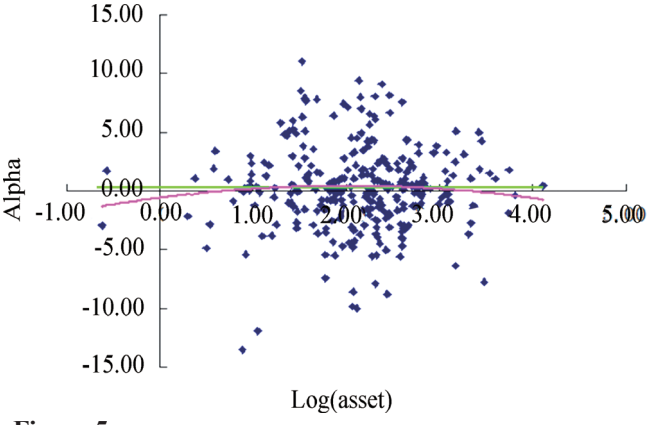

Figure 5
Log of Asset Size VS Alpha

The coefficient of the quadric regression is also insignificant negative. This indicates that there might be no significant relation between fund size and alpha. The findings above are almost consistent with Bodson et al. (2011) and inverse with Ammann and Moerth (2005). Bodson et al. (2011) found that both α and muti-factor α did not show a significant linear or non-linear relationship with fund size. Inversely, Ammann and Moerth (2005) investigated a significant negative relationship between α and fund asset size at the 5% significance level. This finding revealed that lower α for larger funds. The different conclusion might be resulted by the different sample. While in any case, the relatively high Sharpe ratio of small funds is declining the α based on the return. Therefore, fund with small size has more positive α. According to the quadric regression, optimal fund size could be obtained but not significant. Hence, here the use of the quadric regression is restricted.

CONCLUSION

This paper investigates the relation between UK domiciled fund size and performances by detailed analyzing the impact of fund size on return, alpha, Sharpe ratio and Treynor ratio respectively.

By running both linear and quadratic regression based on cross-sectional regression, the empirical evidence presents a statistical significant positive relation between fund size and return and this finding is consistent with Ding et al. (2009) that fund size is positive related to return while Ding et al suggested that this relationship might only for subset of fund universe but not consequentially for the entire fund industry. A negative relation between fund size and Shape ratio is also obtained. This observation is inverse with Ammann and Moerth (2005) who found that the quadratic relation between fund asset size and Sharpe ratio is statistically significant but not obvious from scatter. The result for Treynor ratio is same as Sharp ratio and is consistent with Bodson et al. (2011) who found that the quadratic relation between fund asset size and Sharpe ratio is statistically significant. Moreover, the result shows that the standard deviation is negative convex related to fund size. In general, smaller fund tends to have higher volatility but similar Sharpe ratio. Very small funds have an obviously disadvantage to compete with medium and large scale funds. The result also reveals insignificant result of alpha.

Therefore, this paper warns investors who usually only concerned about the return of funds, that return cannot completely reflect a fund performance because that profits always accompany with risk and it not the higher the better. This point is proved that return is positive related to fund size while there is a negative relation between Sharpe ratio and size. Thus, when investors are selecting funds, one fund return consistently fluctuates while another is more stable, as a rational investor, he/she should absolutely no doubt choose the more stable one to reduce risk.

In order to examine the correlation between rating and performance, I draw a coefficient matrix. According to the result, rating is only positive related to the annualized return and negate related to alpha, Sharpe ratio and Treynor ratio. The negative correlation between rating and both Sharpe ratio and Treynor ratio might due to the less volatility and diseconomy of scale.

These findings indicate that the higher rating is generally accompanied with a high return, but when the risk is considered as the risk-adjusted return like Sharpe ratio and Treynor ratio, these are negative related to fund ratings. Therefore, investors should not choose fund only according to the Morningstar fund rating but think about the risk-adjusted variables.

Furthermore, expect standard derivation, the quadratic relation for return, alpha, Sharpe ratio and Treynor ratio are all concave which allow us to calculate the optimal asset size and zero probit size range. By doing so, the optimal average significant lies between 16.95 and 1159.28 and the profitable asset size rang 1.04 and 1292542.63 million GBP.

To investigate the impact of each performance measurement across Morning Investment Styles (value, blend or growth), I applied linear regression and quadratic regression. Therefore, I find that the relations are almost same as entirely model expect the growth fund's alpha which is significant negative related to fund size and the insignificant relation for growth fund's Treynor ratio.

However, there are some limitations to this study. First, sample limitations. The sample only has 500 data where there are about 9000 data in the UK domiciled fund market. The small sample relatively with the whole market may lead to a deviation of results. Another problem of sample is that there are unequal amount of sub-samples for investment style (growth, blend, value), and this may result in the different observation compared to the entire sample. Secondly, model limitation. When it comes to the optimal asset size and the profitable size range, it makes use of the quadratic model without considering the residual error and therefore it might cause the mismeasure of results. Apart from the above, further researches could focus on the following aspects.

First, as the economy of scale has been regarded as the main reason of the negative relationship between fund size and performances (expect return), more investigation about diseconomy of scale should be analyzed in deep. And fund expense is also an important reason of eroding fund performance, therefore, it is worth to test relationship between fund expenses and size. Secondly, because that there are serval model of alpha, like CAPM, Frama-French model, muti-factor model etc, more kind of alpha could be used to examine the relationship between size and alpha where there is an insignificant result in this study. Thirdly, considering the scale of sample, larger sample should be studied which might obtain more general findings.

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