Does Survivorship Bias of Mutual Funds Differ Between Liquidations and Mergers?

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Abstract
The performance of mutual funds may be misleading due to survivorship bias if the fund family tends to liquidate or merge funds. This paper suggests that funds subject to liquidations and mergers may differ in nature; therefore, this study distinguishes between the two activities. This paper examines whether survivorship bias differs according to whether a fund is liquidated or merged and explores the consequent implications. The empirical results show that Taiwanese equity funds have a survivorship bias of 1.056% annually. After eliminating the merged funds from the sample, we find that fund liquidation is related to performance. This indicates that the factors determining the liquidation and merger of mutual funds have significantly different impacts on the survivorship bias of these funds.

Keywords: mutual fund; survivorship bias; liquidation; merger

JEL classification: G11, G12

Introduction

The survivorship bias of mutual funds is the process by which poorly performing funds disappear from the market while high-performing funds survive. In the long run, all measurements of fund returns are biased. For example, an analysis of the historical returns performance of a fund that has been liquidated or merged due to poor performance, and therefore, has been excluded from the sample population will indicate a good performance because only the existing funds will have been

selected for analysis, leading to survivorship bias. Poorly performing funds would have been neglected in the analysis, thereby causing bias in the results of the analysis. Such a bias will cause investors to be excessively optimistic about the expected rate of returns.

In a mature funds market, poorly performing funds are theoretically eliminated. If this does occur in practice, studies on funds must consider the problem of survivorship bias. Survivorship bias is a function of fund liquidations and mergers, the causes of which can be understood from two perspectives. The first is that of mutual fund companies, the bulk of whose profits come from management fees, which are closely related to fund size. Therefore, mutual fund companies spare no effort in growing their funds. Intuitively, fund size should be proportional to fund performance: highly performing funds should grow, while poorly performing funds should shrink and face being liquidated or merged. However, funds with high returns may give investors redemption incentives through higher investment returns or lower losses, ultimately reducing these funds to liquidation level. Although this process may occur, it has never been confirmed through research.

Second, Articles 45 to 49 of the Securities Investment Trust and Consulting Act provide clear statutory regulations governing the termination, liquidation, and merger of funds. However, there are no statutory regulations with regard to the size threshold for liquidations or mergers. Therefore, mutual fund companies explicitly provide the relevant guidelines in their fund trust contracts based on cost considerations; for example, a fund that has not reached NTD 0.2 billion for 30 consecutive trading days should be liquidated (company costs mainly involve company operating costs; when the size of a fund declines, the management fee income also declines, leading to a relative increase in the fund's cost ratio and damages the fund's ability to operate). During the 2008 U.S. subprime mortgage crisis, the overall market size of funds declined substantially, triggering a wave of fund liquidations in Taiwan. Therefore, at the end of October 2008, the Financial Supervisory Commission (FSC) decided to allow investment trusts to determine their individual standards for fund liquidation. When an investment trust wants to reduce its fund liquidation threshold, it must first apply to the FSC to convene a meeting with the beneficiaries. After FSC approval, the fund prospectus can be modified to reduce the liquidation threshold if at least half the beneficiaries attend and if at least half the attendees agree to such reduction. Thus, whether fund liquidation

and mergers are related to fund performance has not been given statutory confirmation. The relevant evidence indicates that the nature of the relationship between survivorship bias and fund returns remains unknown.

Moreover, the most likely cause of fund liquidation is the shrinkage of the fund below the threshold level; however, this need not be the cause of fund mergers. If a trust company's funds are highly homogeneous, the company will merge funds of the same type to reach economies of scale and reduce its own costs and those of investors. In addition, when facing a liquidation crisis caused by a reduced fund size, a family would be willing to liquidate a portfolio if the portfolio has fewer share classes, but would be more likely to merge a portfolio within the family if it offers more share classes (Zhao, 2005). Investment trusts tend to replace liquidations with mergers because a fund remains under the control of the same company after a merger, which avoids significant reduction in asset management size. It is noteworthy that costs and implementation difficulties in mergers are greater than those in liquidations. If most fund investors purchase from banking channels, the investment trust company can hardly obtain customer data. As a merger requires a meeting of beneficiaries, the banks function as the bridge between trusts and investors. Thus, efficiency often depends on the cooperation of banks, making the implementation of mergers more difficult than that of liquidations. Thus, liquidations and mergers are different in nature. This paper explores whether liquidations and mergers have different impacts on survivorship bias.

This study differs from previous ones because it does not merely focus on survivorship bias in mutual funds; instead, it examines whether the survivorship bias of mutual funds differs between liquidations and mergers. This study aims to distinguish between fund mergers and liquidations before evaluating the survivorship bias and subsequently explore whether the survivorship bias of various fund types differs between liquidations and mergers. Further, it discusses the relationship between the factors affecting survivorship bias and fund liquidations and mergers.

This study's research period spans from January 2000 to December 2011. Monthly data for the 12 years during which open-ended mutual equity funds were issued in Taiwan are used to examine survivorship bias and its factors. A number of prior studies have examined survivorship bias (for example; Brown et al., 1992; Elton et al., 1996;

Hallahan and Faff, 2001; Carhart et al., 2002; and Rohleder et al., 2011; among others) . However, the topic has rarely been explored in the Taiwanese context. The main reason for this research gap is that Taiwan's funds market was not mature until recently. Taiwan's first investment trust was founded in 1983. Due to statutory constraints, Taiwan had only four investment trust companies before 1992, issuing a total of 28 market funds. By 1997, the government had fully liberalized foreign capital and banking activities in the investment trust sector. Given its relatively few funds and scarce cases involving liquidations and mergers, insufficient relevant samples would have been available for study. However, in the last decade, Taiwan's fund market has entered a relatively mature stage, with stable growth in the number of funds and investment trusts. Meanwhile, the database records of liquidated and merged funds are relatively complete, providing robust data for a study on the survivorship bias of mutual funds.

The empirical results reveal that equity funds in Taiwan have a significant annual survivorship bias (1.056%), indicating that the survivorship bias of mutual funds cannot be ignored. Moreover, after eliminating merged funds from the sample, the impact of one-month lagged returns is significantly positive, which means that funds with low returns are much more likely to be liquidated compared to funds with high returns. These results suggest that liquidated funds are the major cause of survivorship bias; mergers and survivorship bias have no significant relationship.

The rest of this paper is organized as follows. Section 2 provides a review of the relevant literature. Section 3 proposes the research design and methodology, including the selection of samples, the definitions of the variables, and the illustrations of the model design. Section 4 discusses the empirical results, and section 5 concludes the study.

Literature Review

Several studies have examined and discussed the survivorship bias of mutual funds. Covering a sample period from 1982 through 1991, Malkiel (1995) classifies funds into total funds and 10-year survival funds to compare their average annual returns. The empirical results show that the survival funds' returns were significantly higher than those of the total funds, confirming the existence of survivorship bias. Carhart (1997) obtained the same results in his study of whether survivorship

bias leads to the overestimation of fund performance. However, Grinblatt and Titman (1992) estimate that survivorship bias is very small and produces an error of only 0.1–0.4% in the annual revenue of mutual funds. Otten and Bams (2004) studied survivorship bias and the inclusion and elimination of liquidated funds; they find that the samples' original return rates exhibited a difference of 0.51%. Aggarwal and Jorion (2010) argue that survivorship bias is very serious and that the average annual fund return bias is as high as 5%. Thus, the relevant extant studies confirm the existence of the survivorship bias; however, survivorship bias may vary across markets. Linnainmaa (2013) estimates a structural model to correct for survivorship bias and to draw inferences about the prevalence of skill among mutual fund managers. Although most funds still have negative alphas, they are not nearly as low as those suggested by the fund-by-fund regressions. Filip (2014) indicate insignificance of survivorship bias in the analyzed mutual fund database in 2000-2012 period in Hungary. The influence of the dissolved funds on the returns of surviving entities in given sub-periods was limited and evaluated differently for each type of funds. Moreover, the asset outflow of the funds classified as non-survivors was moderately correlated with an increase in the number of dissolved funds (but only in some sub-periods), which may be attributed to financial market situation.

In addition to measuring the survivorship bias, some studies have focused on the relationship between survivorship bias and performance persistence. Using U.S. mutual funds as the sample, Carpenter and Lynch's (1999) empirical study showed that mutual fund attrition affects persistence measures, even when the sample includes all non-survivor returns. Gruber (1996) and Hendricks *et al.* (1997) report spurious persistence in samples with both true persistence as well as survivor bias.

Several studies have examined the causes of survivorship bias. Some suggest that survivorship bias is caused by database selection. Elton *et al.* (2001) compare the database of the Center for Research in Security Prices (CRSP) and the Morningstar database; they find return overestimation in the CRSP database and significant differences in the early returns data of small funds. While the CRSP database claims to have no survivorship bias, it does have an omission bias, which can be regarded as part of survivorship bias.

In some studies, the selection of research samples was widened to include hedge funds. Using hedge funds from the Hedge Fund Research (HFR) and the Trading Advisor Selection System (TASS) databases as

the sample, Liang (2000) reviews their survivorship bias after classifying them according to the type of hedge funds. A comparison of the two databases reveals a 2% annual average survivorship bias and identifies poor performance as the major cause of fund elimination. Moreover, after distinguishing fund types and styles, the study finds the databases' measurements of survivorship bias to be different. Baquero *et al.* (2005) examine survivorship and look-ahead biases and performance continuity in their empirical study. Using the hedge funds in the TASS database as their sample, they find that the difference in the annual average return rate for all funds and survival funds in the TASS database is 2.11%. Their study asserts that survivorship bias of hedge funds exists.

Research Design and Methodology

Research samples and data source

Taiwan's mutual funds can be categorized into equity, bond, and balanced funds. These three types account for more than 80% of the total funds in Taiwan. However, according to the investment target classification of the Securities Investment and Consulting Association of the Republic of China (ROC), funds can be categorized into composite, principal guaranteed, real estate securitization, index, and index and equity funds. The focus of our research is the equity fund issued by investment trust companies in Taiwan. The research period is from January 2000 to December 2011, providing 12 years of monthly data. The funds that were transformed from the closed-end funds during the sample period are not within the research scope. For newly established funds, since complete monthly return data did not exist and given the lockout period (after raising funds, in order to establish an investment portfolio's shareholding arrangement, fund managers usually have a lockout period ranging from one to six months; the redemption applications of investors are denied during this lockout period). The data produced six months after their establishment are taken into consideration. The relevant data about the characteristics of the funds in the sample are taken from the database of the Securities Investment and Consulting Association of the ROC, including information about total net assets, net asset value, date of establishment, and turnover rate. The data about the Taiwan Stock Exchange Capitalization Weighted Stock Index (TAIEX) and fund liquidations and mergers are drawn from the Taiwan Economic Journal (TEJ) Database.

Research methodology

The research methodology of this study includes two parts. The first part is the measurement of survivorship bias; the second part is the panel probit regression analysis to discuss the potential factors of the liquidation and merger of funds.

Measurement of fund survivorship bias

According to the definitions proposed by Brown *et al.* (1999), Liang (2000), and Baquero *et al.* (2005), survivorship bias refers to the differences in the returns of the total funds and the survival funds. To measure the implications of survivorship bias more explicitly, the types of funds in this study are further subdivided into all funds, survival funds, liquidated funds, and merged funds. All funds refer to the all the funds of a specific type in the sample period. Survival funds are all the funds in existence at the end of 2011. The liquidated and merged funds are the funds eliminated during the sample period by liquidations and mergers, respectively. The funds surviving after mergers are classified as survival funds. It is noteworthy that liquidated funds and merged funds are both eliminated funds; however, they are discussed separately in this paper primarily because investment trusts would take into account different strategic considerations in deciding whether to liquidate or merge a fund. Hence, this paper expects to describe the nature of survivorship bias more accurately compared to prior studies. Distinguishing the different types of funds can provide an understanding of the existence of survivorship bias and indicate whether survivorship bias varies among the different types of funds.

Fund liquidation and merger model analysis

This paper suggests that funds that are subject to liquidations and mergers may differ in nature, and therefore, distinguishes between the two. First, we exclude the merged fund samples in order to explore the characteristic factors of the liquidated funds and discover whether the research findings vary between the merged and liquidated funds. Second, the sample only excluded the merged fund samples in order to explore the characteristic factors of the liquidated funds and discover whether the research findings vary between the merged and liquidated funds.

Following the liquidation model in Baquero et al. (2005), let $D^*_{i,t}$ be an indicator variable that indicates whether fund *i* liquidates in month t.

Their specification describes the probability of fund liquidation ($D_{i,t}$ = 0) using a longitudinal probit model, such that a fund does not get liquidated or merged if an underlying latent variable ($D^*_{i,t}$) is positive. That is,

$$D^*_{i,t} = \alpha_i + \sum_{j=1}^{J} \eta_{i,t} ER_{i,t-j} + \beta_1 STD_{i,t-1} + \beta_2 AGE_{i,t-1} + \beta_3 TNA_{i,t-1} + \beta_4 TOR_{i,t-1} + \beta_5 NMG_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

and

$$D_{i,t} = \begin{cases} 0 & \text{if fund } i \text{ is liquidated or merged in period } t \quad (D^*_{i,t} \le 0) \\ 1 & \text{otherwise} \end{cases}$$

where $D_{i,t}$ denotes whether fund i in period t was liquidated or merged. Using all the fund samples in the regression, when fund i in period t is liquidated or merged, $D_{i,t}$ = 0, otherwise $D_{i,t}$ = 1. After excluding the merged funds, when fund i in period t is liquidated, $D_{i,t}$ = 0, otherwise $D_{i,t}$ = 1. In the case of liquidation (not mergers), the coefficient $\eta_{i,j}$ denotes how the returns of the fund during the lag period affect the non-liquidated funds; using this coefficient, we analyze how the survival funds are dynamically affected by previous_returns. The independent variable $ER_{i,t}$ is the excess returns for the return horizons (j) of one month, one quarter, one half-year, and one year. The standard deviation of fund returns (STD_{t-1}), fund age (AGE_{t-1}), total net assets (TNA_{t-1}), turnover rate (TOR_{t-1}), and net money growth rate (NMG_{t-1}) are also included as independent variables. Since the investors' response to mergers is different for large and small fund companies (see Ferruz, Ortiz and Vicente, 2008), we use the net money growth model proposed by Zheng (1999) as the measurement method to control for this effect: $NMG_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}(1+R_{i,t})}{TNA_{i,t-1}}$.

Empirical Results and Analysis

Basic statistics

Table 1 presents the statistical data for the sample of funds over 12 years (2000–2011). The number of investment trust companies decreased (after having increased in 2004–2005) and remained steady at around 39

for three years. Following gradual saturation and the alliance between foreign and domestic investment trusts, the investment trusts in Taiwan entered a stage of maturity. The number of equity funds did not change greatly.

Table 1. Number of fund families in each year (2000–2011)

Year	Number of Fund Families	Year	Number of Fund Families
2000	38	2006	41
2001	41	2007	39
2002	44	2008	39
2003	43	2009	39
2004	45	2010	38
2005	45	2011	39

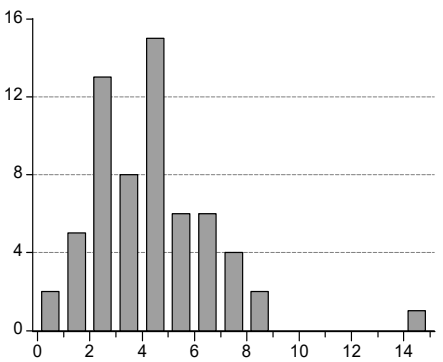
As shown in Table 2, there were 178 funds on average during the sample period. The newly established funds experienced no abrupt increases or decreases (except in 1990). Regarding the number of liquidated and merged funds, investment trusts tended to liquidate funds in the early years. Later, however, investment trusts tended to merge funds. This may have been due to the lowering of the fund liquidation threshold or the increase in the number of investment trust mergers. Further research and confirmation are required for a more accurate explanation.

Table 2. Liquidated and merged equity funds

Year	Number of Funds				Percentage (%)		
	Existing	New Entries	Liquidated	Merged	New Entries	Liquidated	Merged
2000	172	33	9	0	19.19	5.23	0.00
2001	177	17	9	3	9.60	5.08	1.69
2002	179	18	2	15	10.06	1.12	8.38
2003	181	5	6	6	2.76	3.31	3.31
2004	183	2	1	1	1.09	0.55	0.55
2005	180	3	2	10	1.67	1.11	5.56
2006	176	4	4	6	2.27	2.27	3.41
2007	183	9	1	7	4.92	0.55	3.83
2008	175	8	4	12	4.57	2.29	6.86
2009	173	5	1	4	2.89	0.58	2.31
2010	174	5	0	3	2.87	0.00	1.72
2011	179	8	0	3	4.47	0.00	1.68
Total		117	39	70			
Average	178	9.75	3.25	5.83	5.53	1.75	3.27

If the survival period of only the liquidated equity funds is taken into consideration (as shown in Table 2), most of the liquidated funds are found to have survived for 1–2 years or 4–5 years (10 funds), followed by 2–3 years (10 funds); the average survival period is 4.6 years (Figure 1). The fund with the shortest life was the Bowa Successful Equity Fund, which lasted for only 10 months, while the fund that survived the longest was the NITC Fund, which lasted for about 14.1 years (pursuant to the provisions of Article 3 of the Securities Investment Trust Enterprise Management Rules, the Bowa Successful Equity Fund was submitted to the FSC for liquidation on May 9, 2007. After receiving FSC approval, the company was disbanded, and the investment trust business was terminated).

Fig 1. Duration of liquidated equity funds (2000–2011)



Survivorship bias

This section compares the returns of all funds with those of survival funds to test for the existence of survivorship bias. The monthly average return rates and the standard deviations for the various fund types during the sample period are shown in Table 3. The average return rates of the liquidated and merged funds were -0.805% and -0.367%, respectively, which are lower than those of the survival funds (0.305%). The yearly data indicate that the yearly return rates of the liquidated and merged funds were lower than those of the survival funds, except in 2000. Thus, the performance of the liquidated and merged funds was relatively poor.

Lai H. C., Wang K. M. 2016. Does Survivorship Bias of Mutual Funds Differ Between Liquidations and Mergers? Eastern European Business and Economics Journal 2(4): 299 - 314.

	All Funds		Surviving Funds		Liquidated Funds		Merged Funds	
Year	Return	SD	Return	SD	Return	SD	Return	SD
2000	-4.502	9.566	-4.416	9.626	-4.400	8.798	-4.585	9.726
2001	2.660	13.244	2.863	13.348	1.423	12.158	2.264	13.091
2002	-1.897	6.238	-1.838	6.308	-2.196	5.782	-2.062	6.078
2003	1.954	6.422	2.054	6.462	1.096	5.946	1.756	6.363
2004	0.060	5.500	0.177	5.621	-0.213	4.295	-0.317	5.295
2005	2.951	6.885	3.083	6.950	1.515	6.184	2.752	6.728
2006	1.500	4.947	1.569	4.963	1.146	4.747	1.184	5.010
2007	1.126	8.096	1.299	8.030	0.153	9.435	0.837	8.224
2008	-4.711	9.447	-4.669	9.484	-5.768	9.516	-5.140	9.032
2009	5.140	8.260	5.182	8.252	3.955	6.930	4.235	8.518
2010	0.325	5.777	0.352	5.744	N/A	N/A	-0.187	6.402
2011	-1.998	5.387	-1.992	5.390	N/A	N/A	-2.185	5.321
Average	0.217		0.305		-0.805		-0.367	
Survivorship Bias	0.088 (1.056 per year)							
t-Statistic	2.951							

Note: Survivorship bias refers to the differences in the returns of all funds and the surviving funds. Data are not available for 2010 through 2011 because there were no liquidated funds.

Table 3. Survivorship bias of equity funds

A further comparison of the returns reveals that the survival funds' average monthly returns for each year are higher than those of all the other funds. Meanwhile, the t-value reached significance after testing. The annual survivorship bias was 1.056% (0.088% per month), suggesting the existence of survivorship bias for equity funds. It is noteworthy that the liquidated funds' average return rate was -0.805%; this is significantly lower than the average return rate of the merged funds, which reaches a statistically significant difference (t = 2.951). Thus, in addition to the possible differences among the factors driving fund liquidations and mergers, the return rates of the two types of funds may have significant differences.

Thus, for equity funds, the performance of liquidated and merged funds is relatively poor; these funds exhibit significant survivorship bias. The preliminary evidence suggests that the liquidated and merged funds may have been eliminated from the market due to poor performance. However, if the funds are subject to liquidations and mergers because of poor performance, the survivorship bias should decrease when the proportion of liquidated and merged funds in a given period declines. According to Table 2, the percentages of liquidated and merged funds in

2002 and 2008 are relatively high; however, there was a higher level of survivorship bias in 2001, and not in 2002 and 2008. This situation indirectly illustrates that fund liquidations and mergers are not necessarily caused by lower returns. The factors that link survivor bias and poor fund returns are further examined in the following sections.

Factors driving fund liquidations and mergers

To determine the factors that drive the survivorship bias of equities funds, this paper categorizes liquidated and merged funds as eliminated funds and conducts a regression analysis using survival funds. In addition, since the causes of fund liquidations and mergers may differ, we exclude the merged fund samples in order to explore the characteristic factors of the liquidated funds and to determine whether the research findings vary in the case of merged and liquidated funds.

The descriptive statistics in Table 4 indicate that the excess return rate of the funds was positive (0.002) during the sample period; the funds' survival period was 9.652 years. The results of the further analysis in Table 5 suggest that the previous excess return rate and the fund liquidation and merger variable (D_t) were not correlated. Thus, the poor performance of the funds cannot explain their liquidation or merger. Moreover, the funds' standard deviation (STD_{t-1}), age (AGE_{t-1}), and turnover rate (TOR_{t-1}) did not reach significance, suggesting that the fluctuation in the net values of the funds cannot explain their liquidation or merger. Similar to our results regarding the funds' turnover rate, there is no evidence to support the view that older funds had fewer liquidation or merger opportunities.

Table 4. Descriptive statistics of fund-specific factors

Variables	Mean	SD	25th Percentile	Median	75th Percentile
STD	0.028	0.154	0.009	0.017	2.352
AGE	9.652	6.027	3.941	9.936	14.155
TNA	13.864	14.352	12.140	12.890	13.987
TOR	23.338	21.072	9.947	19.380	30.105
NMG	0.002	0.796	-0.042	-0.002	0.006

Note: This table presents the descriptive statistics of the fund characteristics standard deviation (*STD*), fund age (*AGE*), total net asset (*TNA*), turnover rate (*TOR*), and new money growth (*NMG*).

However, the fund size (TNA_{t-1}) and net money growth rate (NMG_{t-1}) variables are positively correlated to the liquidation and merger variable (D_t), suggesting that these two variables are related to the liquidation and mergers of funds. Moreover, when the previous period's fund size and net money growth rate are lower, the probability of the fund being liquidated or merged increases. Thus, fund companies are subject to the constraints of fund size and operating costs. When the fund size is too small, the companies will opt for fund liquidation or merger.

Table 5. Empirical results of the liquidation model

	All Stock Funds			Excluding Merged Funds		
	Estimate	Std. Error	*z*-Statistic	Estimate	Std. Error	*z*-Statistic
ER1	0.020	0.029	0.693	0.097**	0.033	2.901
ER3	0.026	0.025	1.054	0.037	0.026	1.468
ER6	0.017	0.011	1.556	0.031	0.186	0.167
ER12	0.001	0.019	0.068	0.007	0.207	0.357
STD_{t-1}	14.003	24.416	0.571	13.816	24.309	0.576
AGE_{t-1}	0.072	0.215	0.345	0.049	0.230	0.218
TNA_{t-1}	0.973**	0.304	3.199	0.727*	0.354	2.052
TOR_{t-1}	-0.409	0.294	-1.396	-3.699	0.306	-1.211
NMG_{t-1}	2.256**	0.670	3.368	1.717*	0.795	2.166
Intercept	-8.977	3.575	-2.517	-5.823	3.951	-1.479
Wald Chi-Square			33.069			40.744
P-value			0.000			0.000

Notes: This table shows the survivorship bias estimates for the period 2000–2011. The independent variable *ER* is the excess return for the return horizons *j* of one month (*ER1*), one quarter (*ER3*), one half-year (*ER6*), and one year (*ER12*). Standard deviation of fund returns (STD_{t-1}), fund age (AGE_{t-1}), total net assets (TNA_{t-1}), turnover rate (TOR_{t-1}), and net money growth rate (NMG_{t-1}) are also included as independent variables. * and ** denote significance at the 5% and 1% levels, respectively.

Before a fund is liquidated or merged, the previous month's net money growth rate will decrease, suggesting that investors tend to redeem their investments before the liquidation or merger of a fund. However, an examination of the liquidation or merger base day reveals that the freezing periods of the funds differ; thus, these findings should not be considered definite. Before liquidation, the fund company will stipulate the liquidation base day. When the fund company begins the liquidation process, the funds in the account will be frozen for one to three months.

In addition, the fund asset transfer to the surviving fund must be completed within two business days after the fund merger base day; eliminating the assets held by the fund prevents the fund company from making investments in the period between the merger base day and the completion of the asset transfer.

In a Wald chi-square test evaluation model that tested the suitability of the samples, the model variables reached significance after the merged funds were excluded. An observation of the individual variables reveals that more of them reached significance. First, the one-month lagged return (*ER1*) is positively and significantly correlated to the fund liquidation variable (D_t), suggesting that fund liquidation and excess returns are correlated. The previous excess returns in the remaining year were input into the model for analysis; we find that the excessive returns did not reach a significant level, except for the two-month lagged return, whose excessive returns reached a 5% significance level. Accordingly, when the excess returns are lower in the one-month period, the probability of fund liquidation is higher. Thus, while fund mergers may not necessarily be caused by poor performance, liquidation is related to poor performance. The results of our cross-analysis indicate that the major cause of survivorship bias is fund liquidation and that fund mergers have no clear relationship with it.

Conclusions

This paper tests for survivorship bias and explores its possible implications in the context of Taiwan's mutual funds. This paper suggests that funds subject to liquidations and mergers may differ in nature; therefore, this study distinguishes between the two activities. The empirical results indicate that Taiwan's equity funds have a significant annual survivorship bias of 1.056%. Therefore, in the long run, the survivorship bias of funds should not be ignored. After controlling for relevant variables, we find that fund liquidation is related to fund performance—relatively poorly performing funds have a higher probability of being liquidated. In addition, liquidated funds are found to be the major cause of survivorship bias, and fund mergers are found to be irrelevant to survivorship bias. Thus, the factors driving the liquidations and mergers of mutual funds have significantly different impacts on the survivorship bias of these funds.

Lai H. C., Wang K. M. 2016. Does Survivorship Bias of Mutual Funds Differ Between Liquidations and Mergers? Eastern European Business and Economics Journal 2(4): 299 - 314.

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