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## Hedge Fund Attrition and Survivorship Bias Over the Period 1994-2001

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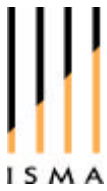

## Abstract

Hedge funds exhibit a high rate of attrition that has increased substantially over time. Using data over the period 1994-2001, we show that lack of size, lack of performance and an increasingly aggressive attitude of old and new fund managers alike are the main factors behind this. Although attrition is high, survivorship bias in hedge fund data is quite modest, which reflects the relatively small difference in performance between surviving and defunct funds. Concentrating on survivors only will overestimate the average hedge fund return by around 2% per annum. For small, young, and leveraged funds, however, the bias can be as high as 4-6%. We also find significant survivorship bias in estimates of the standard deviation, skewness and kurtosis of individual hedge fund returns. When not corrected for, this will lead investors to seriously overestimate the benefits of hedge funds. We find fund of funds attrition to be much lower than for hedge funds. Combined with a small difference in performance between surviving and defunct funds of funds, this yields relatively low survivorship bias estimates for funds of funds.



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## I. Introduction

Hedge funds started out as an investment vehicle aimed at wealthy private investors. Driven by low interest rates, falling equity markets and a lot of peer pressure, however, hedge funds are becoming more and more popular with institutional investors as well. Thanks to substantial media and marketing hype, most institutional investors are nowadays well aware of the supposed benefits of hedge funds: superior performance and diversification combined into one. What many investors do not know, however, is that most hedge funds do not play the game for long. Only 59.5% of the hedge funds that were around five years ago are still alive today. Attrition in hedge funds is not just high, but it is increasing as well. Five years ago 93.8% of the funds alive at the beginning of the year were still alive by the end of the year. Three years ago this percentage was 90.9%. Last year it was only 87.7%.

In this study we take a detailed look at hedge fund attrition over the period 1994-2001. Attrition is important for at least two reasons. First, after a fund has closed its investors will have to look for new investment opportunities. This search is costly, takes time, and may lead to a fund that charges substantial entry fees and/or higher management and/or incentive fees than the old fund. Second, with attrition comes the possibility of survivorship bias. Not accounting for survivorship bias may cause investors to overestimate the returns available from hedge funds, which in turn may lead to a significant over-allocation to this asset class.

We are not the first to study hedge fund attrition. The works of Ackermann, McEnally and Ravenscraft (1999), Bares, Gibson and Gyger (2001), Brown, Goetzmann and Ibbotson (1999), Brown, Goetzmann and Park (2001), Fung and Hsieh (2000), and Liang (2000, 2001) all contain material on hedge fund attrition and survivorship bias. Our study differs from the latter in various ways though. First and most importantly, we use data over the period 1994 - 2001. This means that our data set includes not only the Asian, Russian and LTCM crises but also the end of the IT bubble. None of the above studies uses data more recent than 1999. In addition, a number of them use data from before 1994. Because most database vendors only seriously started collecting data on defunct funds around 1994,[1] hedge fund data from before 1994 are suspect. Second, apart from studying the period 1994-2001 as a whole, we also study shorter, more recent, time periods. This allows us to make inferences about the stability of the attrition rate over time. Third, we classify hedge funds according to size, age, type of strategy, use of leverage, etc. and study attrition for these groups separately. We do so in the simplest way possible: by counting live and dead funds. The advantage of this approach is that we are not confronted with the drawbacks of more complex econometric models. The disadvantage, however, is that due to the large size of the available database we are only able

to perform univariate analyses. Fourth, we take a practical view on survivorship bias, which allows us to directly investigate the importance of survivorship bias for portfolio selection and other decision-making processes that use return forecasts estimated from historical data as inputs.

The paper proceeds as follows. In the next section we briefly discuss the data used. In section III we look at overall hedge fund attrition, while in section IV and V we shed some light on the factors behind hedge fund attrition. In section VI and VII we study hedge fund survivorship bias, section VIII deals with funds of funds and section IX concludes.

**II. The Data**

The data in this study were obtained from Tremont TASS, which is one of the best known and largest hedge fund databases currently available. The database at our disposal contains a total of 2183 hedge funds and funds of hedge funds up to an including May 2001. Due to incomplete and ambiguous data we had to eliminate 171 funds. Since we will discuss funds of funds separately in section VIII, we eliminated the latter from the initial sample as well. Per May 2001 this left us with 1195 live and 526 dead funds. More details about the hedge fund birth and death process over the sample period can be found in table 1. When interpreting table 1, two points are important to note. First, we work with 12-month periods (which for simplicity we will refer to as years) running from June to May instead of from January to December. This allows us to use the most recent data in a consistent manner. Second, 'dead' stands for 'no longer reporting into the database'. Unlike LTCM and some other well known hedge fund failures, the majority of funds that stop reporting don't do so because they go broke but simply because they decide to close down voluntarily. We will discuss the main reasons for this in section IV. Since hedge funds are not allowed to advertise, many consider inclusion in a database as a form of marketing. It has therefore been suggested that another reason why funds stop reporting is that they reach their target asset size and do not need the publicity anymore. Since the target asset size is typically quite high, however, this will only be true for a small minority of funds.

<< Insert Table 1 and 2 >>

Assuming the TASS database is representative for the (unknown) true hedge fund universe, table 1 shows that over the sample period the number of hedge funds has increased very rapidly. The number of dead funds, however, has risen even faster. The relative composition

of the hedge fund universe has changed over time as well. Table 2 shows the proportion of the main categories of hedge funds in the TASS database per June of each year. Over the seven years studied, the relative importance of convertible arbitrage funds has been virtually unchanged. Event driven, emerging market and relative value funds show a slight and global macro funds show a very significant drop. Long/short equity funds on the other hand show a substantial rise, as a result of which they now represent around 50% of the hedge fund universe.

## III. Overall Hedge Fund Attrition

To investigate the overall attrition rate in hedge funds in more detail we calculated what percentage of the funds alive in June of each year survived for more than 1,2, …60 months. The results can be found in table 3.

<< Insert Table 3 >>

Table 3 clearly shows that the attrition rate has increased substantially over time. Of the 455 funds alive in June 1994, 97.80% was still around in June 1995 and 94.73% was still alive in June 1996. However, of the 959 funds alive in June 1997 only 95.10% was still around in June 1998 and only 84.78% in June 1999. Looking at the last year in our sample, we see that of the 1244 funds alive in June 2000 only 87.70% made it through the first year. To understand this phenomenon we need to know more about the factors behind hedge fund attrition. This is what we discuss next.

## IV. The Factors Behind Attrition

The TASS database does not contain information about the reasons why the dead funds stopped reporting. We can, however, easily derive some testable hypotheses based on the fact that managing a hedge fund is a business like any other. As long as it produces the desired results and offers good prospects a fund will not be closed down. This points at the following as the main factors behind hedge fund attrition.

1. **Lack of size**. A fund that is unable to accumulate sufficient assets under management is unlikely to fulfil its manager's expectations or even cover its costs. Also, lack of size could be considered a threat to the manager's professional status.

 

2. **Lack of performance.** Unlike mutual funds, hedge fund managers charge an asymmetric fee in the form of a fixed annual management fee of 1-2% of assets plus an incentive fee of 15-25% of the fund return. For the majority of funds the incentive fee is subject to a so-called 'high watermark' provision. Under such a provision the hedge fund manager has to make up any past losses before the incentive fee is paid. Being under the watermark therefore means that in the short run the manager will not receive any incentive fees. In addition, bad performance will damage the manager's reputation and the fund's track record, which makes it more difficult to sell.

3. **The manager's expectations and business attitude**. How quickly a small and/or badly performing fund will be closed down depends on its manager's expectations and business attitude. A manager with a short-term get-rich-quick attitude may choose to close down quicker than a manager with less inflated expectations and ambitions.

Looking at the determinants of size, performance and attitude, one could argue that fund size will primarily depend on the marketing effort put into raising new capital as well as the fund's historical track record. Selling a fund with a damaged track record is very difficult, especially in today's competitive environment.[2] Fund performance will depend on the usual factors such as type of strategy, degree of leverage, etc. A manager's expectations and inclination to close the fund down may be a function of a number of factors as well. A large fund that performs badly may be closed down less quickly because if it manages to rise above its watermark the revenues will again be substantial. Age might be an issue as well. Many of the investment bankers and portfolio managers that recently gave up top jobs to start their own hedge fund may have higher expectations and be less committed to the business than more seasoned managers. In addition, incurring a dent in one's track record early will be a major hurdle in attaining a viable size. Younger managers may also be more prone to cash flow problems when performance is bad and fee income dries up.

The above provides us with a number of testable hypotheses. First, we would expect a significant difference in attrition between funds of different size as well as funds with different track records. We would also expect to see different attrition rates for funds of different ages, funds with different degrees of leverage, and funds following different types of strategies. In what follows we dissect the attrition figures in table 3 in various ways to shed some more light on these issues.

 

<< Insert Figure 1 >>

**A. Size**

To investigate whether hedge fund attrition depends on size we split up the funds at the beginning of each year into 4 groups according to their assets under management. Group 1 contains all funds with between $0m and $4m under management. The funds in group 2 manage between $4m and $7m, group 3 between $7m and $67m and the funds in group 4 have more than $67m under management. The above classification represents the actual structure of the hedge fund universe. The survival rates for these 4 groups over the first year after classification can be found in figure 1. For brevity we only report the results for 1994/95, 1996/97, 1998/99 and 2000/01. The results for the intermediate years are similar. Figure 1 confirms that lack of size is an important factor behind the observed hedge fund attrition. Over 2000/01 the funds in group 1 show a survival rate of only 66.7%. Survival in group 4 on the other hand is 94.7%.

<< Insert Figure 2 >>

**B. Historical Performance**

Similar to figure 1, figure 2 shows the survival rates over the first year after classification for two groups of funds, classified according to whether their performance over the past 12 months was lower or higher than the average performance of the type of fund in question. From the graphs we see that past 12-month performance has significant discriminatory power as well. Under-performers show a much higher attrition rate than funds whose return over the previous 12 months exceeded the industry average.

<< Insert Figure 3 >>

**C. Age**

We also split the funds in our database into 7 different age groups according to their age at the beginning of each year. The first group contains all funds between 0 and 1 year old, the second group containing all funds between 1 and 2 years, etc. The survival rates for these 7 groups over the first year after classification are shown in figure 3. From the graph we see that age does have some discriminatory power but that the results are not fully in line with the rankings. Especially in recent times, the attrition rate of young funds appears to be relatively

low, while that of older funds seems relatively high. This contradicts the hypothesis that younger funds are more likely to close down than older funds.

<< Insert Figure 4 >>

**D. Leverage**

Another potentially important factor is leverage. Leveraged funds might be more prone to bad performance and might therefore exhibit a higher attrition rate. Figure 4 shows the survival rates of leveraged and non-leveraged funds over the first year after classification. The graphs shows that although leveraged funds show a somewhat higher attrition rate, the difference with non-leveraged funds is only small.

<< Insert Figure 5 >>

**E. Own Money Invested**

Another factor could be whether a manager has his own money invested in the fund. Figure 5 shows the survival rates of funds where the manager does and does not have his own money invested in the fund, again measured over the first year after classification. From the graphs we see that there is no significant difference in attrition between both types of funds.

<< Insert Figure 6 >>

**F. Strategy Followed**

The majority of funds in our sample can be classified into 6 main groups according to the type of strategy followed: convertible arbitrage, event driven, global macro, long/short equity, relative value and emerging markets. Figure 6 shows the survival rates for each of these groups over four 1-year periods. The graphs show significant differences in attrition between some of the different types of funds. In addition, figure 6 also shows that over time the rankings have varied significantly. In 1994/5 many global macro and relative value funds closed down but the other 4 groups hardly showed any attrition. In 1996/7 the situation was already different. Convertible arbitrage, event driven and emerging market funds still showed relatively little attrition, but attrition in long/short equity picked up quite a bit. In 1998/9 we see a remarkable rise in the attrition rate of emerging market and global macro funds, which

 

of course corresponds with the occurrence of the Asian, Russian and LTCM crises around that time. Attrition in convertible arbitrage also rose substantially. Problems in emerging markets and global macro funds appear to have continued into 2000/01. In 2000/01 we also see a drop in the attrition rate of relative value funds, which suggests that the end of the bull market and the IT bubble has offered relative value funds interesting new opportunities.

Figure 6 shows that over the period studied, global macro funds have shown the highest attrition rate. Convertible arbitrage and event driven funds exhibited the lowest attrition rate. One should be careful, however, not to read too much into these results as they appear to be heavily influenced by a small number of major events, which are unlikely to repeat themselves in the near future. Future attrition rates will very much depend on the actual market environment that hedge funds will have to work in.

<< Insert Table 4 >>

The above confirms that lack of size and lack of performance are important factors behind hedge fund attrition. Since we have only looked at one factor at the time, however, it is possible that these factors substitute for each other. We therefore calculated the correlation between the various classifications mentioned under A–F. The results can be found in table 4. Apart from showing that the overlap is not too substantial, table 4 has several other interesting features. Size and performance are positively correlated as good performance attracts new capital and bad performance is a serious hurdle for further growth. Age and size are also positively correlated as for most funds it takes time to grow. Older funds appear to use more leverage than younger funds, but their managers are less likely to have their own money invested in the fund.

## V. What Explains The Acceleration in Attrition?

Hedge fund attrition has increased substantially over time. There are a number of possible explanations for this. One explanation could be that the relative importance of funds that are more likely to close down has increased over time. We therefore studied how the number of funds in the classes used in the previous section changed over time. This showed that the proportion of small, under-performing, leveraged funds has hardly changed over time, which in turn makes it unlikely that the observed acceleration in hedge fund attrition is the result of a shift in the relative importance of particular categories of funds over time.

 

A second explanation could be that many managers do not immediately apply for inclusion in a database. There will always be some time between the start of a fund and its inclusion in a database. As a result, we miss out on funds that close down before they enter the database. If the time between start and inclusion shortened substantially over time this would show up as an increase in the overall attrition rate. We checked this in the database, but found no support for this hypothesis. Since the database was started in 1994, the time between start and entry was very high in 1994/95. In later years, however, the difference between start and entry date was much smaller and more or less stable over time.

<< Insert Table 5 >>

A third explanation could be that over time the market environment has gradually turned against hedge funds. The sample period contains a number of major crises, which, as we saw earlier in figure 6, have had a strong impact on the performance of funds with a more directional strategy. Since most of these crises occurred in 1998/9, however, this does not explain the increase in attrition observed in earlier periods, nor does it explain why attrition has also increased for funds following primarily non-directional strategies. This leaves an exogenous change in fund managers' attitude and expectations. Such a change could be due to the rise of a new breed of hedge fund managers but it could also be the result of a general change in attitude in the hedge fund industry, shared by old and new managers alike. To investigate this we looked at the attrition of the 455 funds that were alive in June 1994. Table 5 shows the (annually rescaled) survival rate over each of the seven 12 month periods from June 1994 until May 2001. Although 1998/9 stands out as a particularly bad year, from the table we see clearly that the survival rate has dropped significantly throughout the 7-year period. Since over the period studied most of these funds show little change in size nor systematically deteriorating performance, this confirms that the hedge fund industry has experienced a significant change in general attitude over time, with managers nowadays closing down much quicker than half a decade ago.

**VI. Survivorship Bias in the Mean**

If surviving and dead funds generate different returns, concentrating on survivors will introduce errors in the estimation of hedge funds' return distributions. This in turn will lead to incorrect decisions in cases where these estimates are used as inputs. Although frequently quoted, the existing literature on hedge fund survivorship bias is somewhat confusing with different authors reporting significantly different results. There are several causes for this.

First, different authors have used different databases. Since many funds report to only one database, this means that different researchers have been looking at different subsets of the hedge fund universe. Second, different researchers have studied hedge funds over different time periods. Since most database vendors only started collecting data on dead funds from 1994 onwards, studies that use data from before 1994 may underestimate the real extend of the bias.[3] Table 6 summarizes the most important articles and papers in the area of hedge fund survivor bias.

<< Insert Table 6 >>

Apart from differences in terms of data used and period studied, the above studies also differ in the way survivorship bias has been calculated. Generally, survivorship bias is calculated as the difference in average returns between two portfolios; one without and one with dead funds. There are, however, several ways in which these portfolios can be constructed. Brown, Goetzmann and Ibbotson calculated survivorship bias as the difference in average return between the portfolio of all funds existing at the end of the sample period and a portfolio containing all funds in the sample (definition A). This definition is also used in Fung and Hsieh (2000) and Bares et al. (2001). Brown, Goetzmann and Ibbotson (1999) also calculated the difference in average return between the portfolio of all funds that survived the entire sample period and the portfolio of all funds in the sample (definition B). In definition A the survivor portfolio represents the returns an investor would have obtained if he had been able to avoid all funds that closed down during the sample period. Definition B is a little more restrictive as the survivor portfolio neither contains any funds that closed down nor any funds that started up during the sample period. A third definition can be found in Liang (2000, 2001) who uses definition A but does so on an annual basis, i.e. by taking the average of the differences in average return between a portfolio of all funds existing at the end of each year and a portfolio containing all funds in that year (definition C).

What definition of survivorship bias is most appropriate depends on the question to be answered. Database vendors typically do not provide their subscribers with data on dead funds. To determine the survivorship bias in the data actually available to investors one should therefore compare the portfolio of funds existing at the end of the sample period with a portfolio of all funds in the sample, i.e. use definition A. Most investors, however, will not use all the data at their disposal. When estimating parameters for portfolio analysis for example they will tend to concentrate on funds for which at least a given number of years of data are available. This means that to determine the bias in the data actually used by investors

 

we should compare the portfolio of all funds that survived the entire sample period with the portfolio of all funds in the sample, i.e. use definition B. This is the approach we will take.

<< Insert Table 7,8, and 9 >>

For time periods ranging from 1 to 7 years, table 7 shows the (annualised) survivorship bias estimates in monthly mean returns for the overall sample as well as a number of subgroups similar to the ones used in section IV. In accordance with the research summarized in table 6, the overall survivorship bias is around 2%. However, there are very significant differences between the various categories. To understand these differences one has to realize that although survivorship bias arises because dead funds perform worse than surviving funds, attrition also plays an important role as it determines the relative weight given to the performance of dead funds. High survivorship bias can be the result of a large difference in performance between surviving and dead funds as well as high attrition. To be able to distinguish these two factors, table 8 reports the difference in mean return between surviving and dead funds and table 9 shows the (annualised) ratio of dead versus surviving funds, both for the same groups and periods as in table 7.

Looking at table 7-9, we see that for small funds the survivorship bias is very substantial. When measured over recent years, small funds exhibit a survivorship bias of more than 5% per annum. This is primarily the result of small funds' high attrition rate though. The difference in performance between surviving and dead funds is not unusually high. Contrary to small funds, the largest funds exhibit hardly any bias. Not only is their attrition rate very low but the difference between surviving and dead funds is also very small and sometimes even negative. This confirms the idea that when (very) large funds stop reporting it is typically not because they close down but simply because they not feel the need to continue reporting. Given that over recent years younger funds have shown a lower attrition rate, it may be somewhat surprising to see that younger funds exhibit more survivorship bias than older funds. The reason of course is that for younger funds the difference in performance between surviving and dead funds is much higher than for older funds. From table 7 we also see that whether a fund is leveraged or not makes a big difference, with the survivorship bias on leveraged funds being more than twice as high as on non-leveraged funds. This primarily reflects the fact that the difference in performance between surviving and dead funds is much higher for leveraged funds than for non-leveraged funds.

 

Table 7 also shows significant differences in survivorship bias between the main types of funds. For convertible arbitrage and event driven funds the bias is significantly below average. For convertible arbitrage this is due to a combination of low attrition and a small and sometimes even negative difference in performance between surviving and dead funds. This suggests that when convertible arbitrage funds close down it is primarily because of lack of size. For event driven funds the small difference between surviving and dead funds is the dominant factor as attrition is almost average. The bias in long/short equity and relative value funds is around average. For long/short equity this is the result of below average attrition and an above average difference in performance between surviving and dead funds. For relative value funds on the other hand both attrition and performance difference are more or less average. Attrition in emerging markets funds is above average. Surprisingly, however, the performance difference between surviving and dead funds is not. As a result, the survivorship bias in emerging markets funds is not too far from average. Global macro funds exhibit a relatively high level of survivorship bias, which primarily reflects their relatively high attrition. The difference between surviving and dead funds is below average.

Apart from showing the existence of substantial differences in survivorship bias for different groups of funds, table 7 also shows that estimates of survivorship bias may vary substantially with the data period used. Overall, the periods 1995 – 2001 and 2000 –2001 tend to produce relatively low estimates. As can be seen from table 8 and 9, there are different reasons for this. The period 2000 – 2001 exhibits relatively low attrition, while the period 1995 – 2001 exhibits a relatively low difference in performance between surviving and dead funds

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**VII. Survivorship Bias in Higher Moments**

A second problem with the available survivorship bias research is that it only looks at the effect of survivorship bias on mean returns. If dead funds differ significantly from surviving funds this might affect the return distribution's higher moments as well. One possible approach would be to compare the survivor portfolio and the portfolio of all funds also in terms of standard deviation, skewness, kurtosis, correlation with the stock market, correlation with the bond market, etc. However, since these two portfolios include different numbers of funds it would be impossible to distinguish between possible diversification effects and true survivorship effects. Moreover, the results would only be valid for portfolios of hedge funds and not for individual funds. To solve this, we decided for the following approach. Starting off with the 455 funds that were alive in June 1994, we created 455 7-year monthly return series by replacing every fund that closed down during the period by a fund randomly

selected from the set of funds in existence at the time of closure. Subsequently, we calculated the average mean return, standard deviation, skewness, kurtosis, and the correlation with the S&P 500 index and the Salomon Brothers Government Bond index. We calculated the same averages from the monthly returns of the 264 funds that survived the full 7-year period. The results plus the differences between both sets of averages can be found in table 10.

<< Insert Table 10 >>

From the table we see that the estimate for the bias in the mean is not too different from what we found before (1.89%). However, from table 10 we also see that concentrating on survivors will introduce a significant downward bias in the standard deviation. Not accounting for fund closures will underestimate the standard deviation of the average individual hedge fund by almost 15%. Not taking closures into account also causes an upward bias in the skewness and a downward bias in the kurtosis estimates. The correlations with the S&P 500 and the bond index also appear to be overestimated. In sum, the above results clearly show that concentrating on survivors may lead one to grossly overestimate the mean return as well as a substantially underestimate the risk of individual hedge funds.

**VIII Funds of Funds**

So far we have concentrated on hedge funds but the TASS database also contains information on 291 funds of funds, i.e. funds that invest solely in hedge funds. As can be seen in table 11, again under the implicit assumption that the TASS database is a proper reflection of the true fund of funds universe, the number of funds of funds has more than doubled over the sample period. The number of closures has grown much faster, however, causing the attrition rate to rise from 0.96% in 1994/5 to 12.65% in 2000/01, which even exceeds the 12.30% we found for hedge funds. Compared to hedge funds the average rate of attrition is quite low though. Assuming size and performance are the main drivers behind fund closure, there are two reasons for this. First, since funds of funds offer investors exactly what they want, i.e. access to a diversified basket of funds without any direct responsibility for fund selection, they are less likely to have problems reaching a viable size. Second, because most funds of funds nowadays tend to invest in a diversified basket of 15 or more hedge funds, they are less prone to bad performance.

<< Insert Table 11 and 12 >>

Similar to table 3, table 12 shows the survival rates of funds of funds alive at in June of each year from 1994 until 2000. The entries confirm that the attrition rate of funds of funds is substantially lower than that of hedge funds. In addition, table 12 makes it clear that over time fund of funds have experienced a similar increase in attrition as hedge funds. As we did for hedge funds, we split our sample of funds of funds up by size, historical performance, etc. and studied the attrition rates for the various groups. As for hedge funds, size and historical performance showed the most significant discriminating power. For brevity, we do not report these results.

<< Insert Table 13 >>

Similar to table 7, table 13 shows the survivorship bias in the mean return of funds of funds, estimated over periods from 1 to 7 years. From the table we clearly see that, reflecting the much lower attrition rate as well as a lower difference in performance between surviving and dead funds, the overall survivorship bias in funds of funds is significantly lower than in hedge funds. Over the period 1994-2001 the survivorship bias amounts to only 0.63% per annum against 1.89% for hedge funds. With the possible exception of leveraged funds and funds where the manager has his own money invested, there does not seem to be much difference between the different classes of funds of funds.

## IX. Conclusion

In this paper we have studied hedge fund and fund of funds attrition and survivorship bias over the period 1994-2001 using data from the Tremont TASS database. Our main conclusions can be summarized as follows:

**Attrition**. Hedge funds exhibit a high level of attrition with the attrition rate showing a marked acceleration over time. Fund of funds attrition is substantially lower but shows a similar acceleration.

**Factors behind attrition**. Lack of size and lack of performance are the main factors behind hedge fund and fund of fund attrition. The observed acceleration in attrition over the sample period cannot be explained by a change in the composition of the hedge fund universe or deteriorating overall performance. Instead, it appears to be due to an increasingly aggressive attitude of old and new managers alike.

 

**Survivorship bias in mean returns**. Concentrating on survivors only will overestimate the average individual hedge fund return by around 2% per annum. However, for small, young and leveraged funds the bias can be as high as 4-6% per annum. Since funds of funds tend to have less problems attaining a viable size and are somewhat protected against bad performance by diversification, survivorship bias in fund of funds' mean returns tends to be fairly small.

**Survivorship bias in higher moments**. Ignoring dead funds may lead to a significant underestimation of the standard deviation and kurtosis as well as overestimation of the skewness of individual hedge fund returns. Together with the inflated mean, this may cause investors to substantially overestimate the benefits of hedge funds.

**FOOTNOTES**

1. HFR started collecting data on dead funds in 1993. TASS and MAR/Zurich Capital Markets both started in 1994.

2. This also explains why, contrary to what theory suggests, Brown, Goetzmann and Park (2001) find that hedge fund managers do not substantially increase volatility after realizing a negative return. Doing so would increase the risk of another negative return, which would further damage the fund's track record and the manager's reputation.

3. The study by Brown, Goetzmann and Ibbotson (1999) is a noteworthy exception as the data used are not taken from a commercial database but hand-collected from the US Offshore Funds Directory by the authors themselves.

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**Table 1: Number of Hedge Funds in Database**

| Period | Beginning | New | Dead | End | Attrition (%) |
|---|---|---|---|---|---|
| 1994-95 | 455 | 151 | 10 | 596 | 2.20 |
| 1995-96 | 596 | 197 | 15 | 778 | 2.52 |
| 1996-97 | 778 | 229 | 48 | 959 | 6.17 |
| 1997-98 | 959 | 330 | 47 | 1242 | 4.90 |
| 1998-99 | 1242 | 83 | 113 | 1212 | 9.10 |
| 1999-00 | 1212 | 172 | 140 | 1244 | 11.55 |
| 2000-01 | 1244 | 104 | 153 | 1195 | 12.30 |

**Table 2: Importance Main Types of Hedge Funds**

This table shows the importance (in % of the total number of funds) of the 6 main types of funds per June of each year.

| Type | 2000 | 1999 | 1998 | 1997 | 1996 | 1995 | 1994 |
|---|---|---|---|---|---|---|---|
| Convertible Arbitrage | 2.41 | 2.48 | 2.66 | 2.50 | 2.44 | 2.68 | 2.20 |
| Global Macro | 5.71 | 6.68 | 7.00 | 7.92 | 8.74 | 9.90 | 11.43 |
| Emerging Markets | 10.21 | 10.89 | 12.00 | 13.76 | 12.72 | 12.58 | 10.33 |
| Event Driven | 14.15 | 14.44 | 14.81 | 14.91 | 16.07 | 15.27 | 16.04 |
| Relative Value | 15.11 | 15.84 | 16.10 | 14.91 | 16.71 | 16.44 | 17.36 |
| Long/Short Equity | 48.39 | 45.21 | 43.16 | 42.02 | 39.59 | 38.92 | 38.02 |

**Table 3: Overall Hedge Fund Survival Rates**

This table shows what percentage of the hedge funds alive in June of each year survived for more than 1,2, .., 60 months.

| Months | 2000 | 1999 | 1998 | 1997 | 1996 | 1995 | 1994 |
|---|---|---|---|---|---|---|---|
| 1 | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |
| 2 | 98.95% | 99.17% | 99.19% | 99.79% | 99.36% | 99.50% | 100.00% |
| 3 | 97.99% | 98.43% | 97.58% | 99.27% | 98.84% | 99.16% | 100.00% |
| 4 | 97.59% | 97.28% | 96.46% | 98.75% | 97.69% | 99.16% | 100.00% |
| 5 | 96.70% | 96.53% | 95.65% | 98.54% | 96.92% | 99.16% | 100.00% |
| 6 | 95.58% | 95.71% | 94.93% | 98.23% | 96.79% | 99.16% | 99.78% |
| 7 | 94.29% | 94.39% | 94.36% | 98.12% | 96.40% | 98.99% | 99.78% |
| 8 | 92.04% | 92.74% | 93.80% | 97.18% | 95.50% | 98.83% | 98.68% |
| 9 | 91.24% | 91.75% | 93.48% | 96.98% | 95.37% | 98.66% | 98.68% |
| 10 | 89.31% | 91.34% | 93.08% | 96.45% | 95.24% | 97.99% | 98.46% |
| 11 | 88.42% | 90.43% | 91.63% | 95.52% | 94.47% | 97.65% | 98.24% |
| 12 | 87.70% | 88.45% | 90.90% | 95.10% | 93.83% | 97.48% | 97.80% |
| 13 | | 87.71% | 90.50% | 94.79% | 93.70% | 97.48% | 97.58% |
| 14 | | 86.63% | 89.86% | 93.85% | 93.57% | 96.64% | 97.14% |
| 15 | | 85.64% | 89.21% | 91.76% | 93.06% | 95.97% | 96.70% |
| 16 | | 85.31% | 88.41% | 90.62% | 92.67% | 94.63% | 96.70% |
| 17 | | 84.57% | 87.76% | 90.20% | 92.54% | 93.62% | 96.70% |
| 18 | | 83.58% | 87.12% | 89.26% | 92.29% | 93.46% | 96.70% |
| 19 | | 82.51% | 86.07% | 88.74% | 92.29% | 92.95% | 96.48% |
| 20 | | 80.36% | 84.54% | 88.22% | 91.13% | 92.11% | 96.26% |
| 21 | | 79.62% | 83.66% | 87.80% | 90.87% | 91.95% | 96.04% |
| 22 | | 78.05% | 83.33% | 87.28% | 90.23% | 91.78% | 95.38% |
| 23 | | 77.23% | 82.77% | 85.51% | 89.59% | 90.94% | 94.95% |
| 24 | | 76.49% | 81.16% | 84.78% | 89.20% | 90.60% | 94.73% |
| 25 | | | 80.52% | 84.46% | 89.07% | 90.44% | 94.73% |
| 26 | | | 79.55% | 83.63% | 88.17% | 90.27% | 93.85% |
| 27 | | | 78.66% | 82.79% | 86.12% | 89.60% | 92.97% |
| 28 | | | 78.50% | 81.86% | 84.83% | 89.09% | 91.43% |
| 29 | | | 77.78% | 81.13% | 84.45% | 88.93% | 90.33% |
| 30 | | | 76.89% | 80.50% | 83.68% | 88.59% | 90.11% |
| 31 | | | 75.93% | 79.56% | 83.16% | 88.59% | 89.45% |
| 32 | | | 73.91% | 78.31% | 82.52% | 88.26% | 88.79% |
| 33 | | | 73.35% | 77.89% | 82.13% | 87.92% | 88.57% |
| 34 | | | 72.46% | 77.69% | 81.75% | 87.42% | 88.35% |
| 35 | | | 71.66% | 77.06% | 79.56% | 86.91% | 87.91% |
| 36 | | | 71.01% | 75.50% | 78.92% | 86.74% | 87.69% |
| 37 | | | | 74.87% | 78.53% | 86.58% | 87.47% |
| 38 | | | | 74.04% | 77.76% | 85.74% | 87.25% |
| 39 | | | | 72.99% | 76.86% | 83.89% | 86.37% |
| 40 | | | | 72.78% | 75.84% | 82.72% | 85.71% |
| 41 | | | | 71.85% | 75.32% | 82.21% | 85.49% |
| 42 | | | | 71.12% | 74.81% | 81.54% | 85.27% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 43 | | | | 70.28% | 74.16% | 81.21% | 85.27% |
| 44 | | | | 67.67% | 73.01% | 80.54% | 84.84% |
| 45 | | | | 67.05% | 72.62% | 80.03% | 84.62% |
| 46 | | | | 66.11% | 72.49% | 79.70% | 84.18% |
| 47 | | | | 65.17% | 71.85% | 77.52% | 83.74% |
| 48 | | | | 64.75% | 70.31% | 76.85% | 83.52% |
| 49 | | | | | 69.67% | 76.68% | 83.30% |
| 50 | | | | | 68.77% | 76.01% | 82.42% |
| 51 | | | | | 67.61% | 75.17% | 81.32% |
| 52 | | | | | 67.35% | 74.50% | 80.66% |
| 53 | | | | | 66.32% | 74.33% | 80.22% |
| 54 | | | | | 65.68% | 73.99% | 79.34% |
| 55 | | | | | 64.78% | 73.15% | 78.90% |
| 56 | | | | | 61.95% | 71.98% | 78.24% |
| 57 | | | | | 61.31% | 71.98% | 77.58% |
| 58 | | | | | 60.41% | 71.98% | 77.14% |
| 59 | | | | | 59.77% | 71.31% | 75.38% |
| 60 | | | | | 59.51% | 69.97% | 74.51% |

**Table 4: Rank Correlation Between Classifications**

| | Size | Performance | Age | Leverage | Own Money |
|---|---|---|---|---|---|
| Size | 1 | | | | |
| Performance | .261(**) | 1 | | | |
| Age | .177(**) | 0.018 | 1 | | |
| Leverage | .070(*) | 0.017 | .140(**) | 1 | |
| Own Money | 0.013 | -0.009 | -.231(**) | .171(**) | 1 |

**Table 5: Survival Rate Hedge Funds Alive in June 1994**

This table shows the survival rates (in %) of the funds alive in June 1994 on an annually rescaled basis.

| Months | 2000/01 | 1999/00 | 1998/99 | 1997/98 | 1996/97 | 1995/96 | 1994/95 |
|---|---|---|---|---|---|---|---|
| 1 | 98.71 | 100.00 | 99.74 | 99.75 | 100.00 | 99.78 | 100.00 |
| 2 | 97.43 | 99.12 | 98.68 | 99.50 | 99.07 | 99.33 | 100.00 |
| 3 | 96.78 | 97.94 | 97.37 | 98.50 | 98.14 | 98.88 | 100.00 |
| 4 | 96.78 | 97.64 | 96.58 | 97.74 | 96.52 | 98.88 | 100.00 |
| 5 | 95.50 | 97.35 | 96.05 | 97.49 | 95.36 | 98.88 | 100.00 |
| 6 | 94.53 | 96.76 | 95.00 | 97.24 | 95.13 | 98.88 | 99.78 |
| 7 | 93.57 | 95.58 | 94.47 | 97.24 | 94.43 | 98.65 | 99.78 |
| 8 | 89.07 | 94.10 | 93.68 | 96.74 | 93.74 | 98.43 | 98.68 |
| 9 | 87.78 | 94.10 | 92.89 | 96.49 | 93.50 | 98.20 | 98.68 |
| 10 | 86.50 | 94.10 | 92.37 | 95.99 | 93.27 | 97.53 | 98.46 |
| 11 | 85.53 | 93.22 | 90.26 | 95.49 | 92.81 | 97.08 | 98.24 |
| 12 | 84.89 | 91.74 | 89.21 | 95.24 | 92.58 | 96.85 | 97.80 |

**Table 6: Survivorship Bias Literature Overview**

| | Definition | Bias (% pa) | Where | Period | Database |
|---|---|---|---|---|---|
| BG and Ibbotson (1999) | B | 0.75 | Table 2 | 1989-1995 | US Offshore |
| BG and Ibbotson (1999) | A | 2.75 | Table 2 | 1989-1995 | US Offshore |
| Fung and Hsieh (2000) | A | 3.00 | Table 1 | 1994-1998 | TASS |
| Liang (2000) | C | 0.39 | Table 3 | 1993-1997 | HFR |
| Liang (2000) | C | 2.24 | Table 3 | 1994-1998 | TASS |
| Liang (2001) | C | 1.69 | Table 3 | 1990-1999 | TASS |
| Liang (2001) | C | 2.43 | Table 3 | 1994-1999 | TASS |
| Bares et al. (2001) | A | 1.30 | Section V.C | 1996-1999 | FRM |

**Table 7: Survivorship Bias in Mean Hedge Fund Returns**

This table shows estimates of the survivorship bias in the mean returns of various groups of hedge funds as obtained over 7 different periods. All estimates are annualised.

| Class | 2000/01 | 1999/01 | 1998/01 | 1997/01 | 1996/01 | 1995/01 | 1994/01 |
|---|---|---|---|---|---|---|---|
| Overall | 0.78 | 2.09 | 2.26 | 2.36 | 2.01 | 1.01 | 1.89 |
| Size 1 | 3.39 | 6.38 | 6.31 | 5.39 | 4.40 | 2.31 | 1.77 |
| Size 2 | 1.37 | 2.37 | 2.57 | 1.97 | 1.64 | 1.37 | 1.62 |
| Size 3 | 0.57 | 1.54 | 1.91 | 1.76 | 2.22 | 1.18 | 1.48 |
| Size 4 | -0.43 | 0.07 | 0.24 | 0.45 | 0.12 | -0.19 | 0.48 |
| Age 1 | 1.17 | 3.01 | 4.18 | 1.53 | 3.48 | 0.56 | 3.13 |
| Age 2 | 1.06 | 4.24 | 1.52 | 3.49 | 0.77 | 2.54 | 2.61 |
| Age 3 | 0.91 | 1.22 | 2.64 | 1.39 | 2.48 | 2.63 | 1.05 |
| Age 4 | -0.08 | 1.67 | 0.65 | 2.36 | 2.44 | 1.26 | 0.12 |
| Age 5 | 1.30 | 0.12 | 2.23 | 2.65 | 1.78 | 0.36 | 1.56 |
| Age 6 | -0.57 | 1.27 | 2.25 | 2.40 | 0.28 | 1.32 | 1.84 |
| Age 7 | 0.98 | 1.79 | 1.86 | 1.35 | 1.29 | 1.38 | 1.02 |
| Money No | 0.60 | 2.30 | 2.65 | 2.38 | 2.17 | 1.30 | 1.83 |
| Money Yes | 0.93 | 1.95 | 2.00 | 1.98 | 1.90 | 1.53 | 1.89 |
| Leverage No | 0.11 | 1.04 | 1.53 | 1.21 | 0.93 | 0.67 | 1.40 |
| Leverage Yes | 1.14 | 2.66 | 2.68 | 2.75 | 2.74 | 2.11 | 2.29 |
| Convert. Arbi. | -0.37 | -0.15 | 0.17 | 0.01 | 0.09 | -0.28 | 0.34 |
| Event Driven | 0.40 | 1.12 | 1.27 | 0.61 | 0.65 | 0.01 | 0.61 |
| Long/Short Eq. | 0.99 | 1.88 | 2.14 | 2.19 | 2.25 | 1.59 | 1.93 |
| Relative Value | 0.85 | 1.45 | 1.80 | 2.21 | 1.70 | 1.80 | 1.87 |
| Emerging Mkts | 0.82 | 3.94 | 2.98 | 1.40 | 1.30 | -0.40 | 1.57 |
| Global Macro | 0.89 | 3.23 | 4.05 | 4.13 | 4.12 | 3.65 | 1.40 |

**Table 8: Difference in Mean Return of Surviving and Dead Funds**

This table shows the differences in the mean returns of surviving and dead funds belonging to various groups of hedge funds. Means are estimated over 7 different periods. All estimates are annualised.

| Class | 2000/01 | 1999/01 | 1998/01 | 1997/01 | 1996/01 | 1995/01 | 1994/01 |
|---|---|---|---|---|---|---|---|
| Overall | 13.12 | 15.02 | 12.84 | 9.63 | 8.03 | 5.13 | 7.30 |
| Size 1 | 7.32 | 12.65 | 12.21 | 8.85 | 7.87 | 4.58 | 4.97 |
| Size 2 | 11.88 | 10.90 | 7.81 | 5.71 | 2.79 | 2.11 | 5.12 |
| Size 3 | 20.57 | 19.41 | 16.29 | 9.93 | 7.83 | 2.11 | 1.62 |
| Size 4 | -10.18 | -0.86 | 1.01 | 2.22 | -0.16 | -3.42 | 2.38 |
| Age 1 | 26.20 | 27.08 | 23.08 | 8.86 | 14.56 | -2.82 | 12.04 |
| Age 2 | 21.03 | 25.47 | 11.07 | 16.45 | -3.06 | 11.01 | 10.41 |
| Age 3 | 13.82 | 10.38 | 17.69 | -2.74 | 12.02 | 11.19 | 6.15 |
| Age 4 | 4.27 | 18.42 | -7.12 | 13.13 | 11.86 | 7.24 | -2.67 |
| Age 5 | 29.06 | -14.32 | 15.65 | 13.86 | 9.46 | -2.63 | 5.88 |
| Age 6 | -33.39 | 11.03 | 16.12 | 12.70 | -3.47 | 5.49 | 7.85 |
| Age 7 | 7.34 | 9.95 | 8.78 | 4.80 | 5.94 | 6.38 | 4.37 |
| Money No | 5.90 | 13.56 | 12.89 | 8.39 | 6.64 | 0.59 | 4.88 |
| Money Yes | 16.02 | 15.29 | 12.64 | 9.98 | 8.66 | 7.07 | 8.17 |
| Leverage No | 0.70 | 6.52 | 7.36 | 3.67 | 2.36 | 1.27 | 5.08 |
| Leverage Yes | 18.05 | 18.32 | 15.51 | 12.59 | 11.91 | 8.86 | 8.92 |
| Convert. Arbi. | -8.08 | -3.40 | 2.03 | 0.60 | 0.73 | -1.51 | 2.71 |
| Event Driven | 4.55 | 7.66 | 6.91 | 3.57 | 3.37 | -0.11 | 2.83 |
| Long/Short Eq. | 21.97 | 18.21 | 15.16 | 11.08 | 10.73 | 7.17 | 11.01 |
| Relative Value | 15.23 | 14.92 | 14.30 | 16.28 | 11.65 | 9.50 | 7.51 |
| Emerging Mkts | 3.30 | 14.19 | 10.23 | 3.32 | -0.25 | -4.59 | 2.01 |
| Global Macro | 0.63 | 8.48 | 11.00 | 8.62 | 8.08 | 7.58 | 2.85 |

**Table 9: Ratio of Dead Funds and Surviving Funds**

This table shows for various groups of hedge funds the ratio of dead and surviving funds over 7 different time periods. For ease of comparison, each ratio has been divided by the number of years in the relevant sample period.

| Class | 2000/01 | 1999/01 | 1998/01 | 1997/01 | 1996/01 | 1995/01 | 1994/01 |
|---|---|---|---|---|---|---|---|
| Overall | 0.14 | 0.15 | 0.14 | 0.14 | 0.14 | 0.12 | 0.10 |
| Size 1 | 0.50 | 0.66 | 0.54 | 0.56 | 0.63 | 0.54 | 0.49 |
| Size 2 | 0.21 | 0.27 | 0.24 | 0.23 | 0.24 | 0.20 | 0.20 |
| Size 3 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 | 0.13 | 0.12 |
| Size 4 | 0.06 | 0.05 | 0.05 | 0.05 | 0.04 | 0.04 | 0.03 |
| Age 1 | 0.10 | 0.13 | 0.14 | 0.12 | 0.15 | 0.13 | 0.12 |
| Age 2 | 0.11 | 0.19 | 0.11 | 0.17 | 0.15 | 0.12 | 0.13 |
| Age 3 | 0.15 | 0.13 | 0.17 | 0.16 | 0.13 | 0.14 | 0.09 |
| Age 4 | 0.11 | 0.19 | 0.17 | 0.11 | 0.16 | 0.10 | 0.11 |
| Age 5 | 0.17 | 0.18 | 0.11 | 0.16 | 0.12 | 0.12 | 0.09 |
| Age 6 | 0.20 | 0.11 | 0.15 | 0.15 | 0.15 | 0.09 | 0.09 |
| Age 7 | 0.16 | 0.15 | 0.13 | 0.11 | 0.09 | 0.08 | 0.06 |
| Money No | 0.12 | 0.16 | 0.15 | 0.15 | 0.16 | 0.14 | 0.13 |
| Money Yes | 0.16 | 0.15 | 0.13 | 0.12 | 0.12 | 0.10 | 0.09 |
| Leverage No | 0.13 | 0.11 | 0.10 | 0.11 | 0.11 | 0.10 | 0.08 |
| Leverage Yes | 0.15 | 0.18 | 0.16 | 0.16 | 0.16 | 0.13 | 0.12 |
| Convert. Arbi. | 0.03 | 0.04 | 0.05 | 0.05 | 0.05 | 0.06 | 0.04 |
| Event Driven | 0.12 | 0.13 | 0.10 | 0.07 | 0.06 | 0.05 | 0.03 |
| Long/Short Eq. | 0.12 | 0.12 | 0.10 | 0.12 | 0.12 | 0.10 | 0.08 |
| Relative Value | 0.11 | 0.16 | 0.17 | 0.19 | 0.21 | 0.19 | 0.22 |
| Emerging Mkts | 0.28 | 0.23 | 0.24 | 0.21 | 0.20 | 0.14 | 0.12 |
| Global Macro | 0.27 | 0.34 | 0.34 | 0.28 | 0.29 | 0.26 | 0.29 |

**Table 10: Overall Individual Hedge Fund Survivorship Bias**

The first row of this table shows the average mean, standard deviation, skewness, kurtosis, correlation with the S&P 500 index, and correlation with the Salomon Brothers Government Bond index calculated over all 264 funds that survived the period 1994-2001. The second row shows the same averages but now calculated over 455 7-year monthly return series corresponding with the 455 funds alive in June 1994 where every fund that closed down during the period is replaced by a fund randomly selected from the set of funds in existence at the time of closure. The survivorship bias estimates in the third row are calculated as the difference between the first two rows. The mean is annualised.

| | Mean | Standard Dev. | Skewness | Kurtosis | Corr. S&P | Corr. Bonds |
|---|---|---|---|---|---|---|
| Surviving Only | 13.3788 | 4.2320 | -0.0618 | 5.1539 | 0.3575 | -0.0343 |
| Including Defunct | 11.8368 | 4.8732 | -0.1274 | 5.6323 | 0.3367 | -0.0413 |
| Survivor Bias | 1.5420 | -0.6412 | 0.0656 | -0.4784 | 0.0208 | 0.0070 |

**Table 11: Number of Funds of Funds in Database**

| Period | Beginning | New | Dead | End | Attrition Rate |
|---|---|---|---|---|---|
| 1994-95 | 104 | 41 | 1 | 144 | 0.96 |
| 1995-96 | 144 | 21 | 2 | 163 | 1.39 |
| 1996-97 | 163 | 36 | 1 | 198 | 0.61 |
| 1997-98 | 198 | 62 | 8 | 252 | 4.04 |
| 1998-99 | 252 | 3 | 12 | 243 | 4.76 |
| 1999-00 | 243 | 22 | 12 | 253 | 4.94 |
| 2000-01 | 253 | 2 | 32 | 223 | 12.65 |

**Table 12: Fund of Funds Survival Rates**

This table shows what percentage of the funds of funds alive in June of each year survived for more than 1,2, .., 60 months

| Months | 2000 | 1999 | 1998 | 1997 | 1996 | 1995 | 1994 |
|---|---|---|---|---|---|---|---|
| 1 | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |
| 2 | 99.21% | 100.00% | 99.60% | 100.00% | 100.00% | 99.31% | 100.00% |
| 3 | 98.42% | 100.00% | 99.21% | 99.49% | 100.00% | 99.31% | 100.00% |
| 4 | 97.63% | 100.00% | 98.81% | 98.48% | 100.00% | 99.31% | 100.00% |
| 5 | 95.65% | 99.59% | 98.02% | 98.48% | 100.00% | 99.31% | 100.00% |
| 6 | 94.07% | 99.59% | 97.62% | 98.48% | 100.00% | 99.31% | 100.00% |
| 7 | 94.07% | 98.35% | 97.62% | 97.98% | 100.00% | 99.31% | 100.00% |
| 8 | 91.70% | 97.53% | 95.24% | 97.47% | 99.39% | 99.31% | 99.04% |
| 9 | 90.91% | 96.30% | 95.24% | 97.47% | 99.39% | 99.31% | 99.04% |
| 10 | 90.12% | 95.88% | 95.24% | 97.47% | 99.39% | 98.61% | 99.04% |
| 11 | 88.14% | 95.06% | 95.24% | 97.47% | 99.39% | 98.61% | 99.04% |
| 12 | 87.35% | 95.06% | 95.24% | 95.96% | 99.39% | 98.61% | 99.04% |
| 13 | | 94.65% | 95.24% | 95.45% | 99.39% | 98.61% | 99.04% |
| 14 | | 93.83% | 95.24% | 94.95% | 99.39% | 98.61% | 98.08% |
| 15 | | 93.00% | 95.24% | 94.44% | 98.77% | 98.61% | 98.08% |
| 16 | | 92.18% | 95.24% | 93.94% | 97.55% | 98.61% | 98.08% |
| 17 | | 90.53% | 95.24% | 92.93% | 97.55% | 98.61% | 98.08% |
| 18 | | 88.89% | 95.24% | 92.42% | 97.55% | 98.61% | 98.08% |
| 19 | | 88.89% | 94.05% | 92.42% | 96.93% | 98.61% | 98.08% |
| 20 | | 86.42% | 93.25% | 89.39% | 96.93% | 98.61% | 98.08% |
| 21 | | 85.60% | 92.06% | 89.39% | 96.93% | 98.61% | 98.08% |
| 22 | | 85.19% | 91.67% | 89.39% | 96.93% | 98.61% | 97.12% |
| 23 | | 83.13% | 90.87% | 89.39% | 96.93% | 98.61% | 97.12% |
| 24 | | 82.30% | 90.87% | 89.39% | 95.09% | 98.61% | 97.12% |
| 25 | | | 90.48% | 89.39% | 94.48% | 98.61% | 97.12% |
| 26 | | | 89.68% | 89.39% | 93.87% | 98.61% | 97.12% |
| 27 | | | 88.89% | 89.39% | 93.25% | 97.92% | 97.12% |
| 28 | | | 88.10% | 89.39% | 92.64% | 96.53% | 97.12% |
| 29 | | | 86.51% | 89.39% | 91.41% | 96.53% | 97.12% |
| 30 | | | 84.92% | 89.39% | 91.41% | 96.53% | 97.12% |
| 31 | | | 84.92% | 89.39% | 91.41% | 95.83% | 97.12% |
| 32 | | | 82.54% | 88.38% | 88.34% | 95.83% | 97.12% |
| 33 | | | 81.75% | 86.87% | 88.34% | 95.83% | 97.12% |
| 34 | | | 81.35% | 86.87% | 88.34% | 95.83% | 97.12% |
| 35 | | | 79.37% | 85.86% | 88.34% | 95.83% | 97.12% |
| 36 | | | 78.57% | 85.86% | 88.34% | 94.44% | 97.12% |
| 37 | | | | 85.86% | 88.34% | 93.75% | 97.12% |
| 38 | | | | 84.85% | 88.34% | 93.06% | 97.12% |
| 39 | | | | 83.84% | 88.34% | 92.36% | 97.12% |
| 40 | | | | 82.83% | 88.34% | 91.67% | 95.19% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 41 | | | | 82.83% | 88.34% | 90.28% | 95.19% |
| 42 | | | | 80.81% | 88.34% | 90.28% | 95.19% |
| 43 | | | | 80.81% | 88.34% | 90.28% | 94.23% |
| 44 | | | | 79.80% | 87.12% | 87.50% | 94.23% |
| 45 | | | | 78.79% | 85.89% | 87.50% | 94.23% |
| 46 | | | | 78.28% | 85.89% | 87.50% | 94.23% |
| 47 | | | | 75.76% | 84.66% | 87.50% | 94.23% |
| 48 | | | | 74.75% | 84.66% | 87.50% | 92.31% |
| 49 | | | | | 84.66% | 87.50% | 92.31% |
| 50 | | | | | 83.44% | 87.50% | 91.35% |
| 51 | | | | | 82.21% | 87.50% | 90.38% |
| 52 | | | | | 80.98% | 87.50% | 89.42% |
| 53 | | | | | 80.98% | 87.50% | 88.46% |
| 54 | | | | | 78.53% | 87.50% | 88.46% |
| 55 | | | | | 78.53% | 87.50% | 88.46% |
| 56 | | | | | 77.30% | 86.81% | 86.54% |
| 57 | | | | | 76.69% | 85.42% | 86.54% |
| 58 | | | | | 76.07% | 85.42% | 86.54% |
| 59 | | | | | 74.23% | 84.03% | 86.54% |
| 60 | | | | | 74.23% | 84.03% | 86.54% |

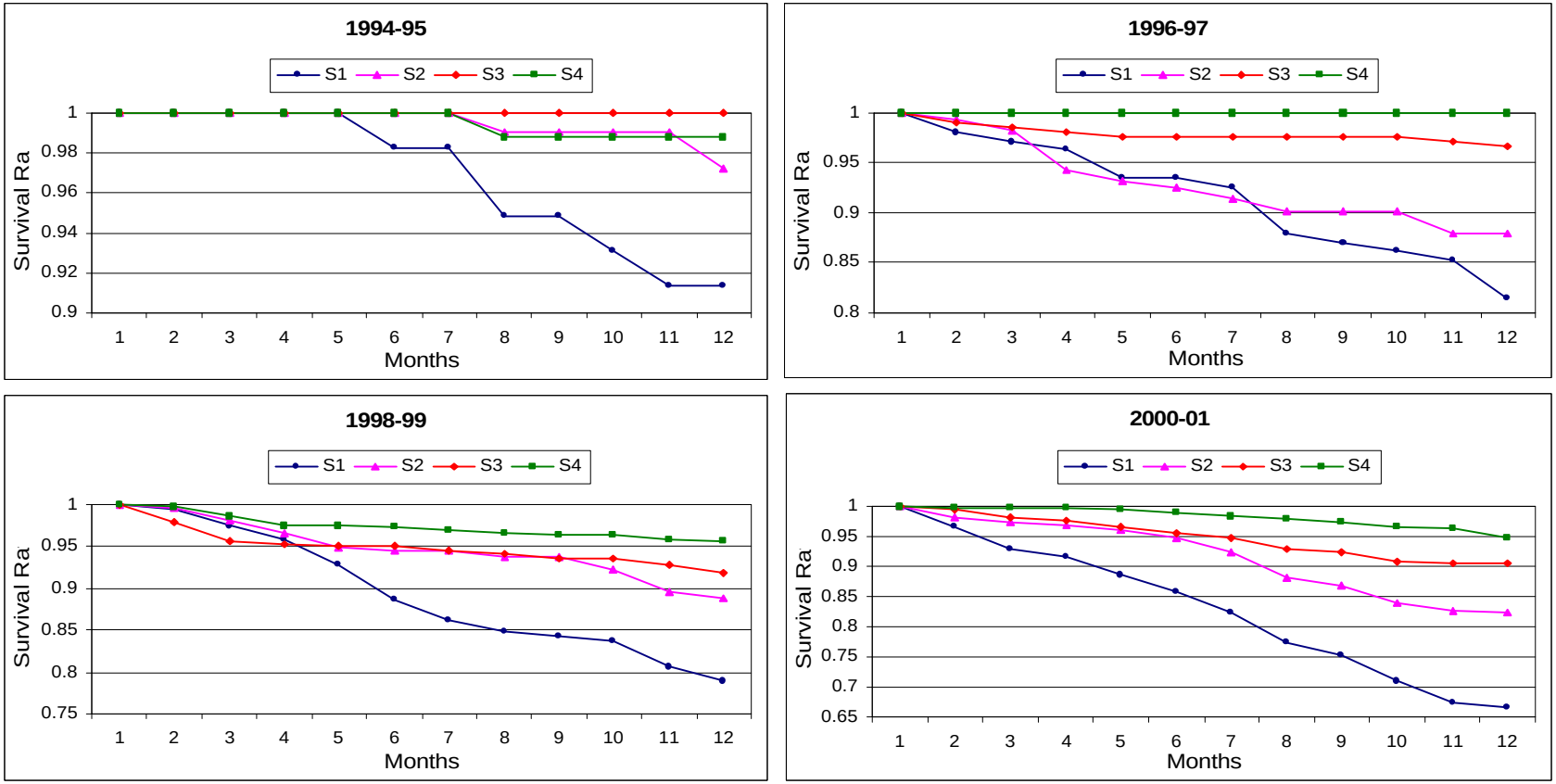
**Table 13: Survivorship Bias in Mean Fund of Funds Returns**

This table shows estimates of the survivorship bias in the mean returns of various groups of funds of funds as obtained over 7 different periods. All estimates are annualised

| Class | 2000/01 | 1999/01 | 1998/01 | 1997/01 | 1996/01 | 1995/01 | 1994/01 |
|---|---|---|---|---|---|---|---|
| Overall | 0.45 | 0.33 | 0.67 | 0.69 | 0.75 | 0.78 | 0.63 |
| Size 1 | 2.43 | -0.22 | 0.63 | -0.35 | 0.66 | 0.17 | -1.03 |
| Size 2 | -0.17 | 0.28 | 0.62 | 0.46 | 0.18 | 0.21 | 0.48 |
| Size 3 | 0.11 | 0.50 | 0.43 | 0.51 | 0.60 | 0.65 | 0.34 |
| Size 4 | -0.04 | -0.18 | 0.05 | 0.17 | 0.24 | 0.33 | 0.35 |
| Age 1 | 0.19 | 0.12 | 1.44 | 0.55 | 1.13 | 1.62 | 0.54 |
| Age 2 | 0.00 | 0.19 | 0.89 | 1.23 | 1.37 | 0.84 | 0.27 |
| Age 3 | 0.65 | 1.53 | 1.08 | 1.01 | 0.89 | 0.21 | 0.67 |
| Age 4 | 2.02 | -0.07 | 0.58 | 0.83 | 0.18 | 0.68 | 0.70 |
| Age 5 | -0.65 | 0.59 | 0.37 | 0.36 | 0.82 | 0.12 | 0.92 |
| Age 6 | 0.40 | 0.91 | 0.05 | 0.69 | 0.47 | 0.09 | 1.26 |
| Age 7 | 0.05 | -0.31 | 0.20 | 0.05 | 0.13 | 0.13 | -0.06 |
| Money No | 0.15 | 0.13 | 0.53 | 0.47 | 0.70 | 0.38 | 0.13 |
| Money Yes | 0.59 | 0.49 | 0.75 | 0.84 | 0.77 | 1.05 | 1.05 |
| Leverage No | 0.50 | -0.01 | 0.21 | 0.34 | 0.46 | 0.39 | 0.23 |
| Leverage Yes | 0.30 | 0.65 | 0.95 | 0.92 | 0.93 | 1.02 | 0.92 |

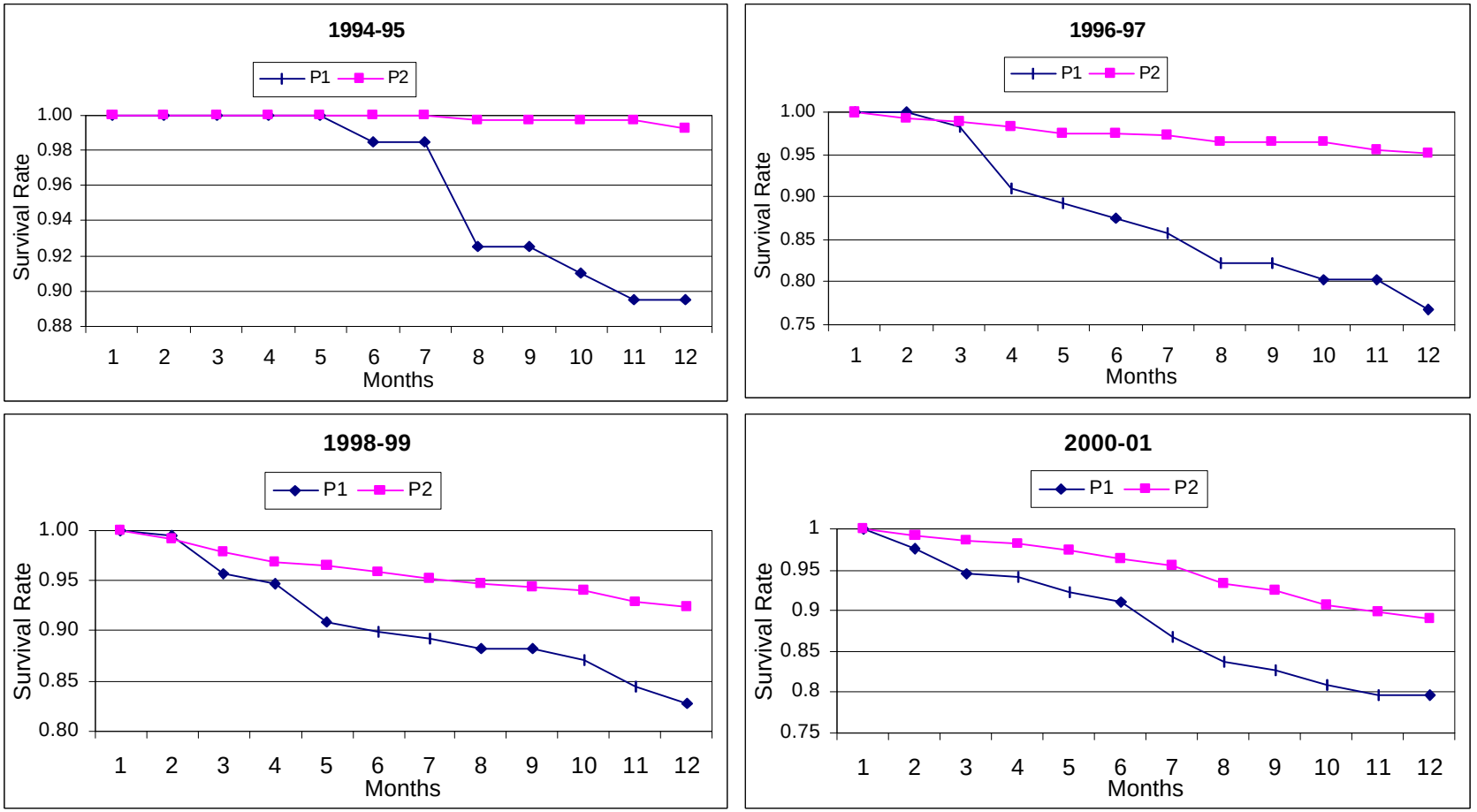
## Figure 1: Attrition and Size

This figure shows the monthly hedge fund survival rates for 4 different groups over 4 different 1-year periods. Group S1 contains all funds with between $0m and $4m under management. The funds in group S2 manage between $4m and $7m, in group S3 between $7m and $67m, and the funds in group S4 have more than $67m under management



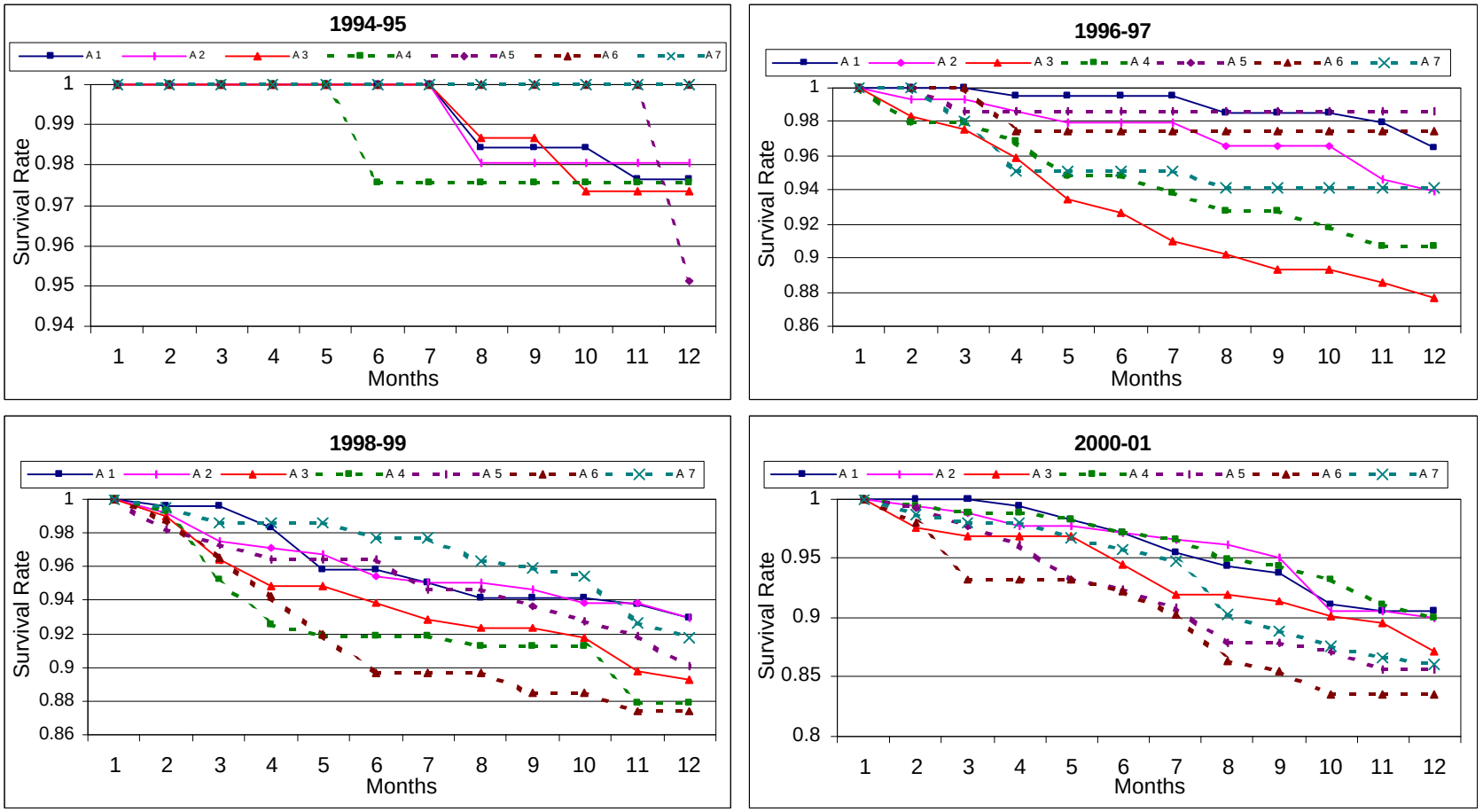
## Figure 2: Attrition and Past 12-Month Performance

This figure shows the monthly hedge fund survival rates for 2 different groups over 4 different 1-year periods. Group P1 contains all funds with a past 12-month performance below the average performance of the type of fund in question. Group P2 contains all other funds.



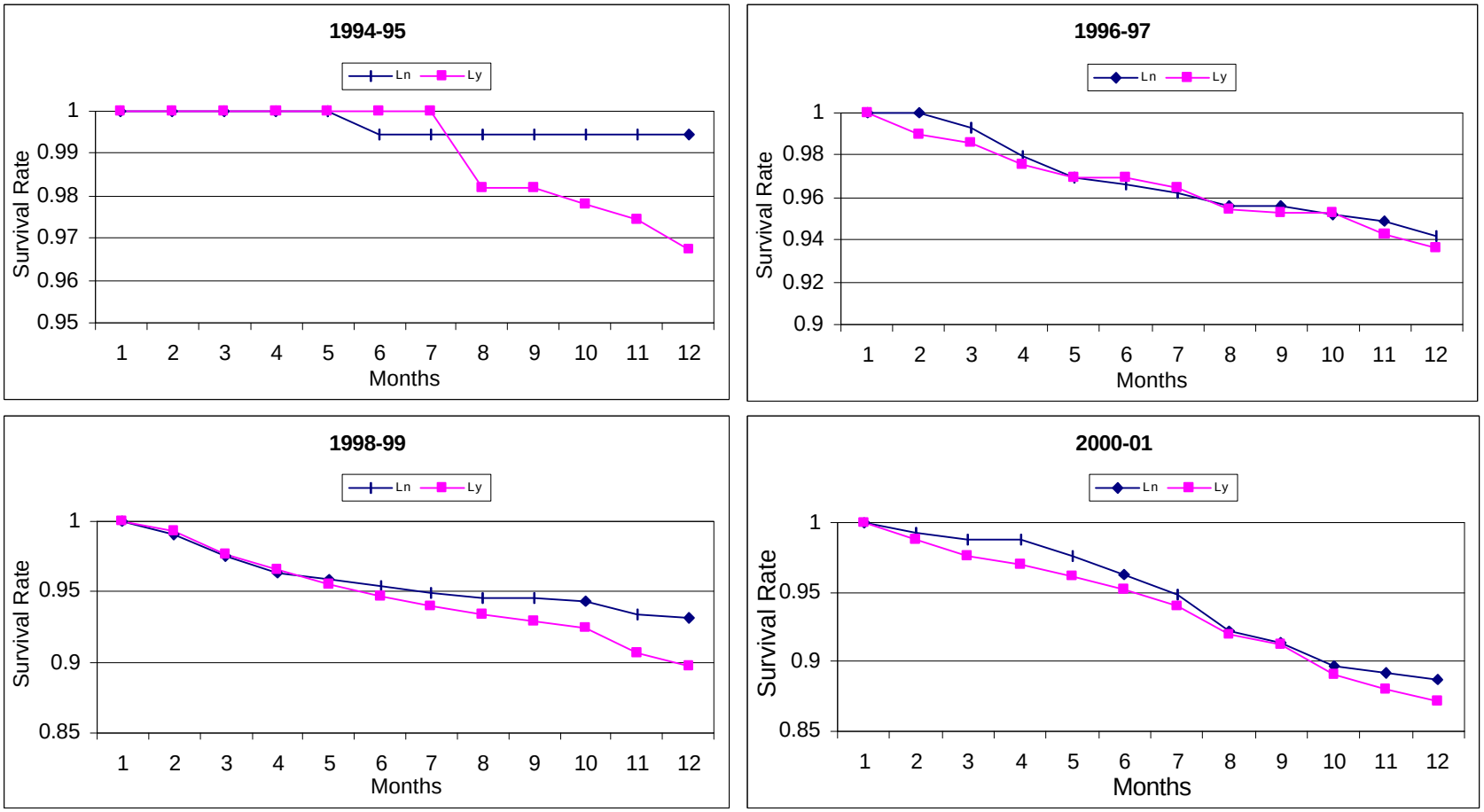
## Figure 3: Attrition and Age

This figure shows the monthly hedge fund survival rates for 7 different groups over 4 different 1-year periods. Group A1 contains all funds between 0 and 1 years of age, group A2 contains all funds between 1 and 2 years of age, etc.



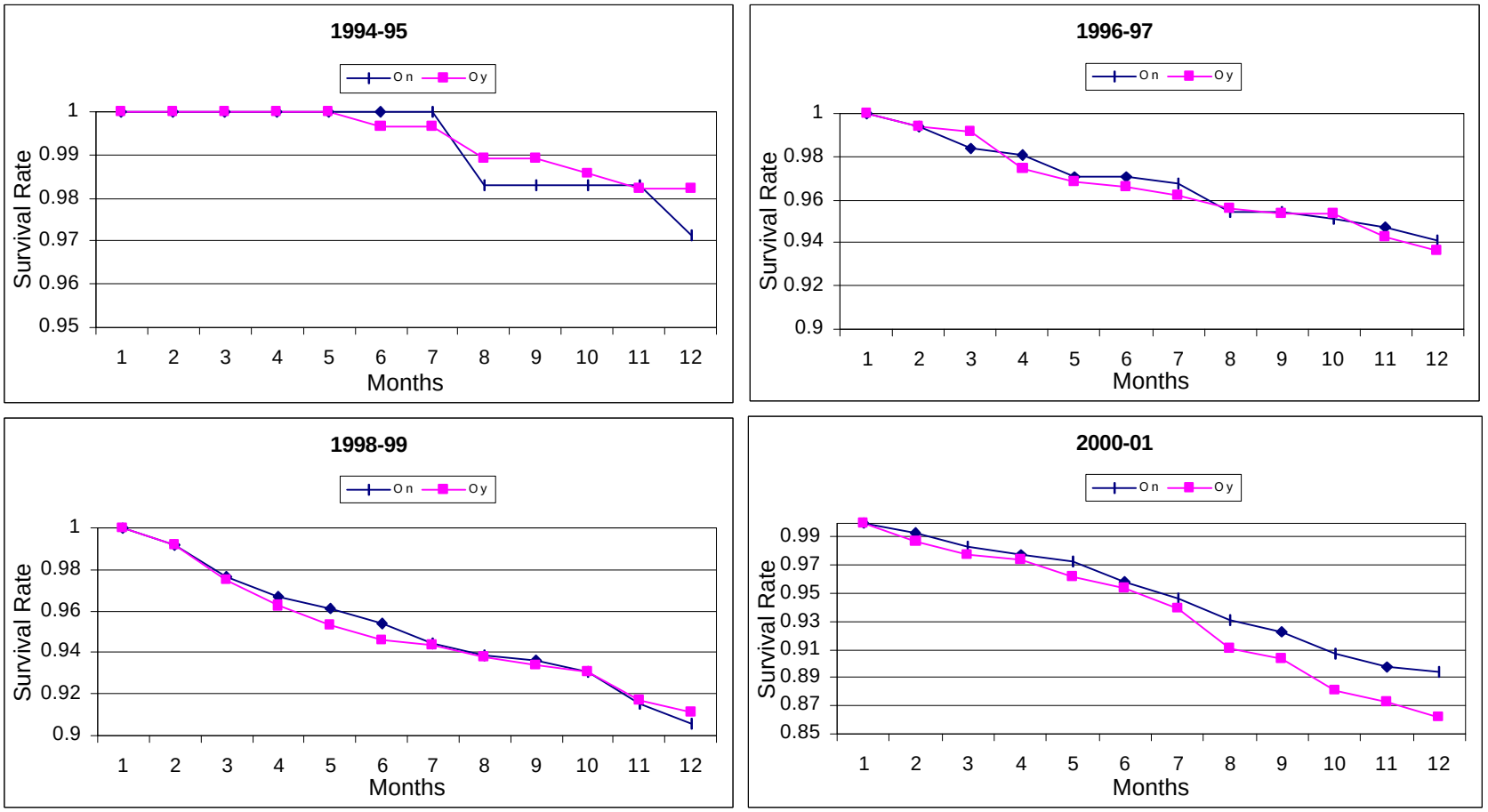
## Figure 4: Attrition and Leverage

This figure shows the monthly hedge fund survival rates for 2 different groups over 4 different 1-year periods. Group Ln contains all funds that do not use leverage and group Ly contains the funds that do use leverage.



## Figure 5: Attrition and Own Money Invested

This figure shows the monthly hedge fund survival rates for 2 different groups over 4 different 1-year periods. Group On contains all funds where the managers do not have their own money invested in the fund and group Oy contains the funds with managers that do.



## Figure 6: Attrition and Strategy Followed

This figure shows the monthly hedge fund survival rates for 6 different groups over 4 different 1-year periods. Group T1 contains all convertible arbitrage funds, group T2 all event driven funds, group T3 all global macro funds, group T4 all/short equity funds, group T5 all relative value funds and group T6 all emerging markets funds.