PARAMETRIC AND NON-PARAMETRIC ANALYSIS OF PERFORMANCE PERSISTENCE IN SPANISH INVESTMENT FUNDS

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ABSTRACT

This paper describes a financial study of performance persistence in a set of Spanish investment funds targeting short-term fixed-income securities. In view of the nature of the funds and market considered, it is therefore a completely new study. The data base is free of survivorship bias.

Moreover, given the nature of the portfolios considered, performance is analysed using a novel index that is based on Sharpe's original but provides consistent rankings for the whole sample employed in the study.

The performance persistence phenomenon is analysed over a dual time horizon (half yearly and annual) using two methodologies. The first of these is a non-parametric (contingency tables) methodology in which the statistical tests of Malkiel, Brown and Goetzmann, and Kahn and Rudd are applied to establish the robustness of the phenomenon studied, while the second is parametric (regression analysis). This joint analysis enables us to consider the effects of changes in the methodology and time horizon on the results obtained.

We can confirm that the phenomenon of persistence is present to a significant degree in the data base used in the study. Consequently, historical fund performance data provides a basis for investment strategies that would yield higher returns than could be achieved in the absence of the persistence phenomenon. Our research also shows that the availability of a greater volume of historical information does not necessarily imply any increase in the level of persistence.

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1. INTRODUCTION AND OBJECTIVES

The Spanish mutual funds market has grown with extraordinary speed since its emergence towards the end of the 1980s, transforming the personal finances of millions citizens and significantly affecting institutional investment.

On aggregate the 1990s saw the fastest growth in financial products of this kind. In the early years of the new century, mutual funds have, however, undergone a period of stagnation and even contraction, though unevenly spread, affecting not only the number of funds and assets under management, but also the returns generated. These setbacks were a consequence of the adverse conditions prevailing in the financial markets in general, and particularly equity markets, during the grim three years between 2000 and 2002.

Once the current economic and political instability has been overcome, mutual funds should recover, despite the fierce competition now coming from alternative savings and investment products, such as high interest online accounts and a wide range of deposits.

At the end of 2002 the total assets managed by mutual funds in Spain came to some € 171 billion, representing 24.6% of GDP. By October 2003, the number of unit holders had risen to 7,663,511 compared to 550,883 in 1990.

These figures reflect the considerable importance of mutual funds in the Spanish market and, in fact, products of this nature currently represent around 12% of family assets.

Let us now turn our attention to short-term fixed-income investment funds. The assets managed in this class of funds have almost doubled since December 2000, and the average volume of funds is now approximately € 340 million compared to around € 16 million in 2000. Meanwhile, average assets per unit holder have increased markedly over the past three years (currently € 31,000 compared to € 24,000 in 2000).

Against this background, we believe that a study of performance persistence in Spanish short-term fixed-income investment funds is of more than passing academic interest and unquestionable social utility, particularly since we are unaware of any other research into performance persistence in this area.

In terms of the contribution to the financial literature on the subject of performance persistence, a further relevant aspect of this research is the use of a data base of short-term fixed-income funds, where it has been usual for financial studies of this nature to employ a sample consisting of equity funds. Furthermore, we have performed similar studies of equity funds which reveal that persistence is weaker than is the case with fixed-income instruments, an observation corroborated by the evidence presented in papers on markets outside Spain (Kahn and Rudd, 1995; Hallahan, 1999).

We have employed both a parametric and a non-parametric methodology to the study of performance persistence with convergent results. We have also carried out the study for two time horizons (annual and half yearly) in order to observe the extent to which the choice of one or other might affect results.

We apply a novel performance measure developed by Ferruz and Sarto (2004a,2004b), which is derived from Sharpe's (1966) original index but ensures coherent rankings even where the portfolio yield is negative.

The study was performed on a total of 207 funds over the period from July 1994 through June 2002. We obtained the data base from the Spanish Securities Market Commission. We would also point out here that all funds existing in the Spanish market were considered at all times in order to avoid survivorship bias.

Survivorship bias is a relevant concern in studies of performance persistence because of the debate surrounding its possible effects on persistence. Two main lines of argument may be distinguished here (Hallahan and Faff, 2001), the first being that of Brown et al (1992) (survivorship bias may give rise to spurious persistence) and the second that followed by Grinblatt and Titman (1992) (survivorship bias diminishes persistence).

On the basis of the above, the objectives of this study are as follows:

- To analyse the performance of these funds using a performance index that is both appropriate and novel.
- Analysis of performance persistence in short-term fixed-income investment funds with particular attention to variations in results depending on the methodology applied (contingency tables vs. regression analysis) and the time horizon selected.

- Determination of the robustness of the performance persistence phenomenon using the statistical tests proposed by Malkiel (1995), Brown and Goetzmann (1995), and Kahn and Rudd (1995).
- Empirical analysis of the utility of the persistence phenomenon to the financial decision-maker in order to highlight the difference in the return obtained by investing in those funds that are consistent winners and the return generated by random investment.
- Analysis of the effects of the volume of historical performance data on the explanatory power of the persistence phenomenon using regression analysis.

In short, then, our general objective is to contribute to the existing financial literature a novel study, as explained above, providing empirical evidence of performance persistence in short-term fixed-income investment funds in the Spanish market.

2. REVIEW OF PREVIOUS RESEARCH

If the measurement of performance has been one of the basic objectives of numerous studies carried out within the conceptual framework of the Portfolio Theory developed by Markowitz (1952, 1987), the persistence of such performance over time has taken shape as a key, even independent, issue in much academic research, with undeniable repercussions both in the professional arena and in terms of social utility.

In applying his eponymous index to a major set of US mutual funds, Sharpe himself (1966) raised the possibility of dividing the time horizon for the study into two sub-periods of ten years each. The result was the discovery of a significant relationship between the rankings for each sub-period.

Jensen (1968) also sought to establish significant relationships between the rankings generated from the application of his α coefficient, although the conclusion he reached was that the explanation for and possible prediction of the performance of the mutual funds he analysed went no further than the results of a straightforward random analysis.

Carlson (1970) studied a set of equity funds over a period of twenty years, finding evidence of performance persistence in some of his results. Specifically, he concludes that there is no evidence of persistence when each of the ten-year periods is analysed separately, but that the phenomenon is detectable if the time horizon is further subdivided into intervals of five years.

All of these studies, however, are affected by the problem of survivorship bias, which is to say they do not take into account all of the funds existing in the class analysed in one or other of the sub-periods into which the total time horizon considered is divided. This circumstance could significantly alter the findings obtained from the studies.

Survivorship bias is also present in some subsequent studies, such as those carried out by McDonald (1974), Shawky (1982), Chang and Lewellen (1984), Henriksson (1984) and Lehmann and Modest (1987). Of the above, the last are the only authors to find any evidence of performance persistence.

The first study to avoid the problem of survivorship bias was carried out by Grinblatt and Titman (1989) in their analysis of equity funds between 1974 and 1984, in which they divided the time horizon considered into two five-year sub-periods.

The main conclusion to be drawn from this work was that the scant evidence of performance persistence found was largely a consequence of the expenses incurred by the portfolios analysed. Thus, fund managers who change the make-up of their portfolios less often, even where results are not satisfactory, usually beat those who are more ready to shuffle their portfolios. This is because the latter incur higher expenses without obtaining the reward of enhanced performance.

In subsequent studies, Grinblatt and Titman (1992, 1993) take a three-step approach (division of the sample into two sub-periods, calculation of abnormal returns in each fund and for each sub-period, and regression analysis), once again finding a certain trend towards persistence, especially in “aggressive growth” funds. Based on the same time horizon as their earlier study, these scholars were able to observe that the top performing 50% of funds in the first five-year period tended to remain winners in the following sub-period.

Brown et al. (1992) also provide empirical results to support the persistence phenomenon, producing evidence that it might be possible to predict the future performance of portfolios. This study is also based on a data base that is free of survivorship bias.

Similar favourable conclusions are to be found in the work of Hendricks et al. (1993), where the expression "hot hands" is used to define persistent winners over a shorter period than in preceding studies, the reference being one year. This study focuses on US growth funds, which show a persistently winning Jensen α. Goetzmann and Ibbotson (1994) reach the same conclusion, differentiating between winner and loser funds based on the returns generated in two-year periods and then analysing performance levels based on a calculation using Jensen's α.

Subsequently, Malkiel (1995), Brown and Goetzmann (1995), and Kahn and Rudd (1995) analysed performance persistence using the contingency tables methodology, a non-parametric method allowing the identification of mutual funds that are persistent winners in two consecutive periods, the losers and the portfolios that change category.

The authors of each of these papers use a statistical test to establish the statistical significance of the possible performance persistence phenomenon.

While Brown and Goetzmann do find some evidence of persistence, the other studies conclude that the existence of the phenomenon is at best partial. In particular, in his analysis of the 1970s and 1980s Malkiel finds the persistence phenomenon in the first decade but not the second. At the same time, this author notes how few of the funds analysed succeeded in beating the benchmark considered in the study. Kahn and Rudd, meanwhile, do find some evidence of persistence in fixed-income funds, but not so for equity portfolios.

In the same paper, Kahn and Rudd also analyse performance persistence using the parametric regression analysis methodology in an attempt to establish whether performance in one period can be explained by that of the preceding period.

The subsequent financial literature on the subject of performance persistence includes a number of papers that discuss multifactor models. Examples of such studies include those by Elton et al. (1996) and Gruber (1996), in which the authors claim to have found statistically significant persistence.

Carhart (1997) uses a four factor model which reveals a certain trend towards performance persistence, although this is mainly a consequence of the number of operations carried out by the portfolios analysed and their associated costs.

More recent studies include the work of Jain and Wu (2000), who have studied the advertised performance of 294 investment funds. These scholars were able to observe that performance was no better after advertising, which leads them to the conclusion that sponsors selected the funds to attract savings on the basis of superior past performance rather than to publicise more efficient management.

Agarwal and Naik (2000) study performance persistence in hedge funds within a multi-period framework (over two years) on the basis of the two sample Kolmogrov-Smirnov multivariable test. These authors found evidence of persistence in the short term (i.e. for quarterly returns), observing that the level of persistence in a multi-period framework is considerably lower than within the two-year framework as a whole.

As we mentioned in the preceding section, Hallahan and Faff (2001) have studied the effect of survivorship bias on performance persistence on the basis of the arguments advanced by Brown et al. (1992) and Grinblatt and Titman (1992). Their study concurs with the latter, finding that performance persistence is diminished by survivorship bias.

Droms and Walker (2001) look at the persistence of returns, trading volume ratios and expenses in a set of investment funds over the period from 1971 through 1990. They develop multi-variable models to identify synergies between persistence in returns, trading volumes and expenses. Though they observe no evidence of long-term performance persistence, these authors do find evidence for the short-term persistence returns.

Davis (2001) finds evidence to support the existence of persistence in the short term among the top growth funds and the worst performing small capitalisation funds.

Ibbotson and Patel (2002) analyse style adjusted performance persistence in US equity funds, but only consider the better performing portfolios. These scholars found evidence of persistence among winner funds. Their approach involves α

adjustments for style, while performance is considered in both absolute and relative terms.

Capocci and Hübner (2003) study the performance of a wide range of hedge funds using various asset valuation models. Thus, Carhart's 4-factor model is applied in combination with the models proposed by Fama and French (1998), Agarwal and Naik (2002) and an additional factor that takes possible investments by hedge funds in emerging bond markets into account. They conclude that persistence exists in the intermediate fund deciles but not at the extremes.

Wermers (2003) found from his recent study that a part of the persistence observable in the returns obtained by mutual funds may be attributed to the tendency of investors actively to seek out funds that have obtained high returns in the past. The arrival of such investors raises stock prices.

While the US market has been widely studied in relation to the performance persistence phenomenon, the first studies of persistence in European markets have begun to appear only in recent years.

The work of Ribeiro et al. (1999) on the Portuguese equity market is a case in point. These authors use the contingency tables methodology to appraise performance persistence, making adjustments based on Yates' continuity correction and Fisher's exact value of p to avoid the bias inherent in a small sample (12 funds).

Otten and Bams (2002) analyse persistence in various Euro area funds, applying conditional and non-conditional asset valuation models based on Carhart's (1997) four factors.

Menéndez and Álvarez (2000) consider persistence in the returns obtained by Spanish equity funds on the basis of regressions. They also compare the returns obtained on these funds against the Ibex-35 and Madrid General Stock Market indices.

Finally, Ferruz et al. (2003) have analysed performance persistence in Spanish short-term fixed-income funds using the non-parametric contingency tables methodology, finding that persistence did exist during the period considered (1994-2002).

3. MEASURING PERFORMANCE USING SHARPE'S ORIGINAL RATIO AND AN ALTERNATIVE INDEX

As noted above, the starting point for this analysis of fund management performance is Sharpe's (1966) original index, which is expressed as follows:

$$S_p = \frac{E_p - R_f}{\sigma_p}$$

This represents the additional return obtained on a portfolio p (E_p) over risk free assets (R_f) per unit of total risk, which is expressed in terms of the standard deviation of the return on the portfolio (σ_p).

In certain circumstances, however, Sharpe's index may give rise to inconsistencies in the treatment of risk and, therefore, in the ranking of portfolios.

Thus:
$$\frac{\delta S_p}{\delta \sigma_p} = -\frac{E_p - R_f}{\sigma_p^2}$$

This partial derivative should always be negative since risk is an undesirable factor for the investor. This is not, however, the case if the return premium on the portfolio is negative, resulting in inconsistent treatment of the total portfolio risk.

To avoid this, Ferruz and Sarto (2004a, 2004b) propose considering the return premium on each portfolio in relative terms. Thus:

$$S_p(1) = \frac{E_p / R_f}{\sigma_p}$$

This new measure provides consistent rankings for any set of portfolios with the sole requirement that $E_p>0$ holds for all.

Consequently, the S_p (1) ratio may be considered an appropriate alternative to Sharpe's original measure, particularly when the set of portfolios analysed contains a subset with negative premium returns.

4. METHODOLOGIES TO ESTABLISH PORTFOLIO PERFORMANCE PERSISTENCE

Starting from the application of the alternative performance ratio $S_p(1)$, this study uses a contingency tables (non-parametric) methodology and regression analysis (parametric methodology) to investigate the possible presence of the performance persistence phenomenon.

Contingency tables

The contingency tables methodology is based on comparison of performance rankings in two consecutive periods, identifying the two sub-sets of "winners" (W) and "losers" (L) on the basis of the median. We also apply the financial/statistical tests proposed by Malkiel (1995), Brown and Goetzmann (1995), and Kahn and Rudd (1995) to analyse the robustness of the persistence phenomenon:

→ Malkiel's (1995) Z-test, the expression of which is as follows:

$$Z = (Y\text{-}np)/\sqrt{np(1-p)}$$

Where:

- Z is the statistical variable, which has a normal distribution (0,1).
- Y is the number of winner portfolios in two consecutive periods.
- n is WW + WL.

→ Brown's and Goetzmann's (1995) odds ratio (OR):

$$OR = \frac{WW \times LL}{WL \times LW}$$

A Z-test that also follows a normal distribution (0,1) is calculated on the basis of this value such that:

$$Z = \frac{\ln(OR)}{\sigma_{\ln(OR)}}$$

→Kahn's and Rudd's (1995) χ^2-test:

$$\chi^2 = \sum_{i=1}^{n} \sum_{j=1}^{n} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Where:

- O_{ij} is the actual frequency of the i^{th} row and ^{jth} column.
- E_{ij} is the expected frequency of the i^{th} row and j^{th} column.

Regression analysis

The regression analysis method also allows us to establish the possible existence of the performance persistence phenomenon. This is because we may use it to discover whether performance in the prior period is a good predictor of performance in the next. This is the model used by scholars such as Grinblatt and Titman (1993), and Kahn and Rudd (1995).

Thus, the statistical significance of the relationship between performance in a given period and that of the immediately prior period would be established on the basis of *ex post* values using the following regression:

$$P_{p(t+1)} = \alpha_P + \beta_p P_{p(t)} + \varepsilon_p$$

$P_{p(t+1)}$ and $P_{p(t)}$ respectively represent the performance of the portfolio p in the periods t+1 and t.

Positive β values with significant t-statistics would confirm the existence of performance persistence.

5. EMPIRICAL ANALYSIS

We shall now proceed to carry out an empirical financial analysis of performance persistence for all of the short-term fixed interest investment funds in Spain during the period from July 1994 to June 2002, thereby avoiding any survivorship bias.

The analysis of performance persistence is based on computations over six-monthly and annual periods.

Initially, we calculate the performance of each fund in each sub-period using the alternative $S_p(1)$ ratio on the basis of the returns produced by risk free assets such as Treasury Bill repos, as well as net daily returns for each of the funds considered.

Tables 1 and 2 respectively show the six-monthly and annual contingency tables. On the basis of the results shown in the tables, we may affirm that there is indeed a certain trend towards performance persistence, since the number of funds repeating as winners or losers is higher than the number that change their status.

To confirm this intuitive finding, the statistical tests defined in the preceding section are applied. This analysis is illustrated in tables 3 and 4. It confirms the robustness of the performance persistence phenomenon.

Finally, the parametric regression analysis referred to in the preceding section is also applied on both a six-monthly and an annual basis. The results obtained from this methodology are summarised in tables 5 and 6.

From these tables, we may observe that in all of the analyses (both annual and six-monthly for all of the sub-periods considered) there is a certain trend indicative of performance persistence, because the values obtained for the β parameters are always positive with significant t-statistics.

Though the values of R^2 are not particularly high, this is usual in cross-section analyses.

Starting from this regression analysis methodology, we then carry out a complementary study with the objective of establishing whether an increase in the quantity of historical fund data causes a rise in their explanatory power over future results.

This analysis involves dividing the total eight-year period into two sub-periods each of four years. A series of regressions are then performed in order to explain performance in each of the years in the second sub-period in terms of performance in the immediately prior year, two prior years, three prior years and four prior years.

This process is summarised in tables 7 to 10 and is defined on the basis of the following regressions:

$$\begin{cases} P_{p(98\text{-}99)} = \alpha_P + \beta_1 P_{p(97\text{-}98)} + \varepsilon_p \\ P_{p(98\text{-}99)} = \alpha_P + \beta_2 P_{p(96\text{-}98)} + \varepsilon_p \\ P_{p(98\text{-}99)} = \alpha_P + \beta_3 P_{p(95\text{-}98)} + \varepsilon_p \\ P_{p(98\text{-}99)} = \alpha_P + \beta_4 P_{p(94\text{-}98)} + \varepsilon_p \end{cases} \qquad \begin{cases} P_{p(99\text{-}00)} = \alpha_P + \beta_1 P_{p(98\text{-}99)} + \varepsilon_p \\ P_{p(99\text{-}00)} = \alpha_P + \beta_2 P_{p(97\text{-}99)} + \varepsilon_p \\ P_{p(99\text{-}00)} = \alpha_P + \beta_3 P_{p(96\text{-}99)} + \varepsilon_p \\ P_{p(99\text{-}00)} = \alpha_P + \beta_4 P_{p(95\text{-}99)} + \varepsilon_p \end{cases}$$

$$\begin{cases} P_{p(00\text{-}01)} = \alpha_P + \beta_1 P_{p(99\text{-}00)} + \varepsilon_p \\ P_{p(00\text{-}01)} = \alpha_P + \beta_2 P_{p(98\text{-}00)} + \varepsilon_p \\ P_{p(00\text{-}01)} = \alpha_P + \beta_3 P_{p(97\text{-}00)} + \varepsilon_p \\ P_{p(00\text{-}01)} = \alpha_P + \beta_4 P_{p(96\text{-}00)} + \varepsilon_p \end{cases} \qquad \begin{cases} P_{p(01\text{-}02)} = \alpha_P + \beta_1 P_{p(00\text{-}01)} + \varepsilon_p \\ P_{p(01\text{-}02)} = \alpha_P + \beta_2 P_{p(99\text{-}01)} + \varepsilon_p \\ P_{p(01\text{-}02)} = \alpha_P + \beta_3 P_{p(98\text{-}01)} + \varepsilon_p \\ P_{p(01\text{-}02)} = \alpha_P + \beta_4 P_{p(97\text{-}01)} + \varepsilon_p \end{cases}$$

This analysis therefore seeks to validate the following hypotheses:

$$\begin{cases} H_1 : \beta_1 < \beta_2 < \beta_3 < \beta_4 \\ H_2 : R^2_1 < R^2_2 < R^2_3 < R^2_4 \end{cases}$$

If these hypotheses are validated, we may affirm that as the period of historical data increases, so performance persistence is greater, raising explanatory power in the subsequent period.

The above tables confirm that all of the β coefficients are positive with significant t-statistics, thereby reinforcing the existence of performance persistence.

The evolution of the β coefficients is consistent in almost all cases with the H_1 hypothesis, except in fact in table 10. However, the adjusted R^2 do not support hypothesis H_2, which may be because we have carried out a cross-section analysis.

6. UTILITY OF THE PHENOMENON OF PERSISTENCE

Let us turn now to consider the two main uses or applications of the performance persistence phenomenon. In the first place, it allows mutual fund managers to determine their position vis-à-vis their competitors while at the same time indicating the need to make changes to or continue with their management style. Secondly, it allows financial decision-makers to compare investment alternatives on a harmonised basis and to prepare rankings as an aid to arriving at rational financial choices.

Analytically, we may demonstrate the benefits mentioned in the preceding paragraph shown through a simplified case study. Let us consider two possible investment alternatives.

The first consists of investing in all of the investment funds forming part of our sample, while the second would be to invest in each period in the top performing 5% or 10% of funds in the prior period.

The total sum invested and time horizon are equal for each investment option.

It is essential to remember here that returns data are presented net of commissions and other transaction costs in this simulation.

On the basis of an annual calculation, the first alternative would provide an annual return of 3.81%, while the second would generate 3.98% if the investment in each period was made in the top performing 5% of funds in the prior period, and 3.97% if the sum were invested in the top 10%.

On the six-monthly calculation basis, the first investment option would provide an annual return of 4%, while the systematic investments would generate 4.18% (top 5%) and 4.22% (top 10%).

It is clear, then, that the second investment option is at all times better from the point of view of the returns obtained. Hence, it would have been useful for the decision-maker, fund manager or financial investor to have known about the existence of the performance persistence phenomenon in the fixed interest funds. Investing in winners would have generated above average returns.

7. CONCLUSIONS

- In this study we have applied a completely new performance index derived from Sharpe's original. This measure makes it possible to correct the inconsistencies produced by Sharpe's index in certain situations arising in the markets. Specifically, these inconsistencies appear where returns on some or all of the portfolios analysed (mutual funds in the present case) are less than the return on risk-free assets.

- For the first time, this study provides empirical evidence of persistence in Spanish short-term fixed-income mutual funds. The study, carried out on an annual and half yearly basis, uses an eight-year data base that is free of survivorship bias.

- To confirm the existence of the persistence phenomenon, we have applied two methodologies. The first of these is non-parametric, using contingency tables, and is supported by the Malkiel, Brown and Goetzmann, and Kahn and Rudd statistical tests to determine the statistical significance of the process analysed. The second is a parametric methodology involving regression analysis. On this basis, we may assert that the past performance of the funds has explanatory power for future performance.

- The possibility that a larger quantity of historical performance data for the portfolios will increase the explanatory power of the regression has not been fully established. Nevertheless, we have been able to confirm that the values of the β parameters increase in line with the length of the period over which data are available.

- The performance persistence phenomenon has utility for decision-makers in that it enables them to implement systematic investment strategies that will generate higher returns than they would have obtained if they had invested randomly.

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	WW	WL	LW	LL
2hy94-1hy95	51	15	16	50
1hy95-2hy95	53	14	18	49
2hy95-1hy96	62	11	14	59
1hy96-2hy96	53	23	22	53
2hy96-1hy97	57	21	22	56
1hy97-2hy97	64	25	24	65
2hy97-1hy98	74	22	24	71
1hy98-2hy98	74	26	25	74
2hy98-1hy99	75	25	25	74
1hy99-2hy99	67	32	32	66
2hy99-1hy00	81	17	18	80
1hy00-2hy00	70	29	26	68
2hy00-1hy01	65	26	24	64
1hy01-2hy01	61	27	23	56
2hy01-1hy02	58	21	23	59
TOTALS	**965**	**334**	**336**	**944**

Table 1. Contingency tables resulting from the application of Sp(1) on a six-monthly basis.

	WW	WL	LW	LL
Jul 94/Jun 95 vs. Jul 95/Jun 96	51	15	19	47
Jul 95/Jun 96 vs. Jul 96/Jun 97	56	17	20	53
Jul 96/Jun 97 vs. Jul 97/Jun 98	53	24	19	59
Jul 97/Jun 98 vs. Jul 98/Jun 99	68	27	27	66
Jul 98/Jun 99 vs. Jul 99/Jun 00	66	32	31	65
Jul 99/Jun 00 vs. Jul 00/Jun 01	73	23	16	65
Jul 00/Jun 01 vs. Jul 01/Jun 02	51	31	28	48
TOTALS	**418**	**169**	**160**	**403**

Table 2. Contingency tables resulting from the application of Sp(1) on an annual basis.

	Z	p		OR	Z	p		$\chi 2$	p	
2hy94-1hy95	4,43	0	**	10,63	5,75	0	**	37.15	0	**
1hy95-2hy95	4,76	0	**	10,31	5,72	0	**	37.04	0	**
2hy95-1hy96	5,97	0	**	23,75	7,17	0	**	63.37	0	**
1hy96-2hy96	3,44	0,001	**	5,55	4,82	0	**	24.66	0	**
2hy96-1hy97	4,08	0	**	6,91	5,39	0	**	31.44	0	**
1hy97-2hy97	4,13	0	**	6,93	5,77	0	**	35.98	0	**
2hy97-1hy98	5,31	0	**	9,95	6,78	0	**	51.45	0	**
1hy98-2hy98	4,80	0	**	8,42	6,56	0	**	47.29	0	**
2hy98-1hy99	5,00	0	**	8,88	6,68	0	**	49.26	0	**
1hy99-2hy99	3,52	0	**	4,32	4,81	0	**	24.18	0	**
2hy99-1hy00	6,46	0	**	21,18	8,18	0	**	81.02	0	**
1hy00-2hy00	4,12	0	**	6,31	5,77	0	**	35.83	0	**
2hy00-1hy01	4,09	0	**	6,67	5,69	0	**	34.92	0	**
1hy01-2hy01	3,62	0	**	5,50	5,03	0	**	27.37	0	**
2hy01-1hy02	4,16	0	**	7,08	5,53	0	**	33.16	0	**
TOTALS	**17,51**	**0**	**	**8,12**	**23,32**	**0**	**	**595.58**	**0**	**

Table 3. Results of the persistence analysis applying the statistical tests of Malkiel, Brown and Goetzmann, and Kahn and Rudd on a six-monthly basis.

** Statistically significant at a level of 1%.

	Z	p		OR	Z	p		$\chi 2$	p	
Jul 94/Jun 95 vs. Jul 95/Jun 96	4.43	0	**	8.41	5.32	0	**	31.52	0	**
Jul 95/Jun 96 vs. Jul 96/Jun 97	4.56	0	**	8.73	5.68	0	**	35.75	0	**
Jul 96/Jun 97 vs. Jul 97/Jun 98	3.30	0.001	**	6.86	5.34	0	**	31.50	0	**
Jul 97/Jun 98 vs. Jul 98/Jun 99	4.21	0	**	6.16	5.64	0	**	34.09	0	**
Jul 98/Jun 99 vs. Jul 99/Jun 00	3.43	0.001	**	4.32	4.77	0	**	23.86	0	**
Jul 99/Jun 00 vs. Jul 00/Jun 01	5.10	0	**	12.89	6.96	0	**	56.65	0	**
Jul 00/Jun 01 vs. Jul 01/Jun 02	2.21	0.027	*	2.82	3.15	0.002	**	10.35	0.001	**
TOTALS	**10.28**	**0**	**	**6.23**	**14.01**	**0**	**	**211.02**	**0**	**

Table 4. Results of the persistence analysis applying the statistical tests of Malkiel, Brown and Goetzmann, and Kahn and Rudd on an annual basis.

* Statistically significant at a level of 5%.

** Statistically significant at a level of 1%.

x	y	Number of funds	α	t	β	t	Adj. R^2
2hy94	1hy95	132	4359.2	(11,6)**	0.329	(6.6)**	0.247
1hy95	2hy95	134	3429.9	(6.8)**	0.524	(7.1)**	0.272
2hy95	1hy96	146	3157.4	(6.2)**	0.702	(9.7)**	0.389
1hy96	2hy96	151	3753.9	(5.5)**	0.715	(8.5)**	0.324
2hy96	1hy97	156	3379.0	(3.3)**	0.723	(6.7)**	0.221
1hy97	2hy97	178	6459.9	(7.9)**	0.533	(6.8)**	0.201
2hy97	1hy98	191	5094.3	(7.0)**	0.690	(11.6)**	0.411
1hy98	2hy98	199	4797.1	(4.4)**	0.771	(9.5)**	0.312
2hy98	1hy99	199	-153.7	(-0.1)	0.970	(10.0)**	0.334
1hy99	2hy99	197	3328.4	(3.3)**	0.707	(10.6)**	0.362
2hy99	1hy00	196	4087.2	(9.1)**	0.507	(17.4)**	0.606
1hy00	2hy00	193	9741.6	(21.5)**	0.303	(8.0)**	0.247
2hy00	1hy01	179	5548.4	(6.3)**	0.529	(8.0)**	0.263
1hy01	2hy01	167	517.7	(0.4)	1.023	(10.4)**	0.394
2hy01	1hy02	161	2984.8	(2.9)**	0.776	(10.5)**	0.406

Table 5. Results of the regressions based on performance persistence calculated on a six-monthly basis.

** Statistically significant at a level of 1%.

x	y	Number of funds	α	t	β	t	Adj. R^2
Jul 94/Jun 95	Jul 95/Jun 96	132	4323.7	(10.7)**	0.446	(7.8)**	0.316
Jul 95/Jun 96	Jul 96/Jun 97	146	3092.4	(4.0)**	0.877	(8.4)**	0.327
Jul 96/Jun 97	Jul 97/Jun 98	155	4997.5	(4.3)**	0.747	(6.2)**	0.197
Jul 97/Jun 98	Jul 98/Jun 99	188	1055.2	(0.9)	1.031	(10.5)**	0.369
Jul 98/Jun 99	Jul 99/Jun 00	194	2812.1	(2.4)*	0.606	(7.5)**	0.221
Jul 99/Jun 00	Jul 00/Jun 01	177	8987.4	(19.5)**	0.302	(8.3)**	0.277
Jul 00/Jun 01	Jul 01/Jun 02	158	2767.0	(1.9)	0.777	(6.9)**	0.228

Table 6. Results of the regressions based on performance persistence calculated on an annual basis.

* Statistically significant at a level of 5%.

** Statistically significant at a level of 1%.

x	y	Number of funds	α	t	β	t	Adj.R^2
Jul 97/Jun 98	Jul 98/Jun 99	188	1055.2	(0.9)	1.031	(10.5)**	0.368
Jul 96/Jun 98	Jul 98/Jun 99	152	838.4	(0.4)	1.251	(6.6)**	0.22
Jul 95/Jun 98	Jul 98/Jun 99	142	-2203.8	(-0.9)	1.939	(6.4)**	0.22
Jul 94/Jun 98	Jul 98/Jun 99	128	-1865.5	(-0.8)	1.991	(6.4)**	0.237

Table 7. Results of the performance regressions for the year from July 1998 to June 1999 based on performance in prior years.

** Statistically significant at a level of 1%.

x	y	Number of funds	α	t	β	t	Adj.R^2
Jul 98/Jun 99	Jul 99/Jun 00	194	2812.0	(2.4)*	0.606	(7.5)**	0.221
Jul 97/Jun 99	Jul 99/Jun 00	184	-597.9	(-0.4)	0.958	(7.7)**	0.243
Jul 96/Jun 99	Jul 99/Jun 00	148	-3056.0	(-1.3)	1.358	(5.9)**	0.188
Jul 95/Jun 99	Jul 99/Jun 00	138	-5447.7	(-1.6)	1.961	(4.7)**	0.135

Table 8. Results of the performance regressions for the year from July 1999 to June 2000 based on performance in prior years.

* Statistically significant at a level of 5%.

** Statistically significant at a level of 1%.

x	y	Number of funds	α	t	β	t	Adj.R^2
Jul 99/Jun 00	Jul 00/Jun 01	177	8987.4	(19.5)**	0.302	(8.3)**	0.278
Jul 98/Jun 00	Jul 00/Jun 01	176	8390.7	(14.7)**	0.344	(7.6)**	0.244
Jul 97/Jun 00	Jul 00/Jun 01	166	7024.9	(9.4)**	0.488	(7.7)**	0.26
Jul 96/Jun 00	Jul 00/Jun 01	133	4368.2	(3.9)**	0.853	(7.3)**	0.287

Table 9. Results of the performance regressions for the year from July 2000 to June 2001 based on performance in prior years.

** Statistically significant at a level of 1%.

x	y	Number of funds	α	t	β	t	Adj.R^2
Jul 00/Jun 01	Jul 01/Jun 02	158	2767.0	(1.9)	0.777	(6.9)**	0.227
Jul 99/Jun 01	Jul 01/Jun 02	158	5290.0	(4.3)**	0.667	(6.2)**	0.191
Jul 98/Jun 01	Jul 01/Jun 02	157	4673.9	(3.8)**	0.698	(6.6)**	0.214
Jul 97/Jun 01	Jul 01/Jun 02	147	4294.1	(3.8)**	0.729	(6.1)**	0.197

Table 10. Results of the performance regressions for the year from July 2001 to June 2002 based on performance in prior years.

** Statistically significant at a level of 1%.