"Performance, Style and Persistence of Italian Equity Funds"

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All Comments Welcome

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Abstract

This paper provides a comprehensive analysis of the risk-return characteristics, risk exposures, style analysis and performance persistence of Italian equity mutual funds. We examine performance measures based on absolute benchmarks (*Sharpe ratio*, *Sortino ratio*, *Treynor ratio*), on relative benchmarks (*Morningstar Rating*) and on customized benchmarks (*Information ratio*). These last two measures are, in particular, very interesting because they are well known among American investors, but in Italy, classification based on these measures are virtually non-existent. Finally, using non-parametric method, called *Cross Product Ratio* and *Chi Squared test* we examine persistence in the performance of mutual fund managers. We find a reasonable degree of persistence and evidence of differential managers skill.

Introduction

Mutual funds are now the preferred way for individual investors and many institutions to participate in the capital markets, and their popularity has increased demand for evaluations of fund performance.

In this paper we examine the performance persistence of Italian equity mutual funds over the period 1997 through 2000. In particular we consider three categories of performance indicators. We consider measures based on *absolute benchmarks*, measures based on *relative benchmarks* and finally measures based on *customized benchmarks*[1].

The first category considers the traditional risk-adjusted measures: Sharpe Ratio, Sortino Ratio and Treynor Ratio, that differ only for the evaluation of the risk component. The second category consider a new measure, *Morningstar Risk-adjusted Rating*, useful to evaluate only the peer group universe of managers, so it is possible to compare really competitive products, and we use returns based style analysis to evaluate the homogeneity of our sample. This measure is well known among American investors, but Morningstar-like classifications are virtually non-existent in the Italian mutual fund market. The last category is very interesting, because from 2000 Italy is the first country in Europe where, by law, the *customized benchmark* must be contained in each mutual fund's prospectus and in its application, to help mutual fund investors by offering market "standards" and in order to be able to evaluate the risk and the return of their own investments. In this case we estimate the information ratio of every fund of the sample.

We compare the fund's ranking produced by every risk-adjusted performance considered above for every period, using *Spearman's rank order correlation* coefficient. Finally, using non-parametric methods, called *Cross-product rati*o and *Chi square test*, we examine the "*hot hand phenomenon*" in the performance of mutual fund managers.

The organization of the paper is as follows: in section one we describe the sample of valuation; in section two we estimate the risk-adjusted performance measures; in section three we describe all the methodologies used to perform the persistence tests. Section four concludes.

[1] See Kritzman [1986]; Aldrich [1987]; Mossavar-Rahmani [1987]; Rennie, Cowhey [1990].

1. The data

We collected a data set of weekly[2] returns for all funds classified as "Azionari Italia" by Assogestioni[3] from January 1997 to December 2000, a period which covers market ups and downs over stable and turbulent periods. We took into consideration any changes in the names of funds. The sample is determined combining this criteria with another restriction: mutual funds must be active at least at December 1999, so in our analysis we consider only funds that have at least a year of sample observations. The data set is calculated on the basis of total return indexes that measure the total returns on the underlying funds, combining both capital performances and reinvested incomes from dividends.

The sample does not present *attrition rate*, defined as the percentage of dead funds in the total number of funds, but is affected, even in a very limited way, by *survivorship bias*[4]. In fact, even if the data set captures changes in the names of mutual funds, the selection procedure does not include funds that changed investment policy. However, it seems rational to say that the operations affect the Italian market only marginally: these are typical operations of a full market, with high levels of competition (Malkiel [1995]).

2. Performance measures

2.1. Risk-adjusted measures based on absolute benchmark

Sharpe Ratio

The most commonly used measure of risk-adjusted performance is the Sharpe ratio (Sharpe [1966]), which measures the fund's excess return per unit of its risk. The Sharpe ratio can be expressed as follows:

$$Sharpe\ Ratio = \frac{fund's\ average\ excess\ return}{standard\ deviation\ of\ \ fund\ excess\ return}$$

[2] We collect a dataset of weekly observations, and not monthly observations as in numerous previous studies, to have a better estimate of the performance measures. For example, Casarin, Pellizzon, Piva [2000] evaluate performance measures from a monthly database.

[3] The Assogestioni (the Italian mutual funds association) classification is widely used in Italy: it currently includes 24 different categories, based on the prevailing asset classes of investment.

[4] Survivorship bias arises if investors' withdrawals push the poorly performing funds out of the market, so only the superior funds survive. Therefore, samples which exclude funds that perished because of their inferior performance are biased towards finding persistence. See, in particular, Brown, Goetzmann, Ibbotson and Ross [1992], Brown and Goetzmann [1995] and Hendricks, Patel and Zeckhauser [1997].

The Sharpe ratio is based on the trade-off between risk and return. A high Sharpe ratio means that the fund delivers a considerable return for its level of volatility. The Sharpe ratio allows a direct comparison of the risk-adjusted performance of any two mutual funds, regardless of their volatilities and their correlations with a benchmark.

It is important to keep in mind that the relevance of a risk-adjusted measure such as the Sharpe ratio for choosing a mutual fund depends critically on investors' ability to do two things:

- to combine an investment in a mutual fund with an investment in the riskless asset;
- to leverage the investment by, for example, borrowing money to invest in the mutual fund. (For the result to hold exactly, the investor must be able to borrow and lend at the same risk-free rate). This is because the combination of investing in any given mutual fund and in a riskless asset allows one to lower the risk of the combined investment at the price of the corresponding reduction in expected return. Alternatively, leveraging one's investment in the fund allows one to increase expected return at the price of the corresponding increase in risk. Thus, any level of risk can be achieved with the given fund, and so the investor can achieve the best combination of risk and return by investing in the fund with the highest Sharpe ratio, regardless of the investor's own degree of risk tolerance.

Sortino Ratio

Standard deviation is sometimes criticized as being an inadequate measure of risk because investors do not dislike variability *per se*. Rather, they dislike losses, but are quite happy to receive unexpected gains. One way to meet this objection is to calculate a measure of downside variability, which takes account of losses but not of gains. The downside deviation considers only those returns that fall below a defined target rate, called the *Minimum Acceptable Return* (*MAR*), rather than the arithmetic mean. The Sortino ratio measures the return of the fund in excess of the return of the *MAR*, per unit of downside deviation.

$$Sortino\ \ Ratio = \frac{fund's\ \ excess\ \ return\ \ from\ \ MAR}{downside\ \ deviation} \qquad \text{where}$$

$$downside\ \ deviation = \sqrt{\ VAR\ \left[\min\left(0, fund's\ \ excess\ \ return\ \ from\ \ MAR\right)\right]}$$

Treynor Ratio

The Treynor ratio is a risk/return measure similar to the Sharpe Ratio. It measures the return of the fund in excess of the risk-free return, per unit of risk that the fund adds to a well-diversified portfolio. The Sharpe Ratio uses the standard deviation as a measure of risk, while the Treynor ratio uses the fund beta β , the systematic risk measure.

$$Treynor\ \ Ratio = \frac{fund's\ average\ excess\ return}{\beta} \text{ where}$$

$$\beta = \frac{\text{cov}(fund's\ return, Market's\ return)}{\text{var}(Market)}$$

2.2. Risk adjusted measures based on relative benchmark

Style analysis.

One of the aims of this analysis is to evaluate the persistence of Italian Mutual funds. In order to make meaningful comparisons, funds must be classified into homogeneous risk categories, so it is possible to compare really competitive products. For this reason we consider only the category "Azionari Italia" (Italian equity) from Assogestioni (the Italian mutual funds association). We use *returns based style analysis* to evaluate the homogeneity of this category.

Since its introduction[5] in 1989, returns-based style analysis has fundamentally changed the way many investment analysts assess the behaviour of money managers. In practice, returns-based style analysis is a statistical technique that identifies what combination of long positions in passive indexes would most closely replicate the actual performance of a fund over a specified time period. The passive indexes selected must represent distinct investment styles within particular asset classes. Typically, style indexes will break a broad market index down into four (or more) mutually exclusive components, usually defined as large and small (or small/medium), growth and value segments. A style analysis model will then aim to quantify the exposures of a portfolio to these four style components as expressed by the

[5] Returns-based style analysis was first introduced by Sharpe in two articles "Determining a Fund's Effective Asset Mix," [1988], and "Asset allocation: Management style and performance measurement," [1992]. Sharpe originally used the terms "effective asset mix" and "attribution analysis" describing his work. In recent years the term "returns-based style analysis" has frequently been used to describe the Sharpe method. Finally, "correlational analysis" and "return pattern analysis" (first put forth by consultants at Frank Russell) have also been used.

indexes (and the underlying exposures to securities within the index universes). The basic tenet of style analysis is that a passive portfolio can be constructed by combining the four indexes. Therefore, a manager can be considered to add value only when performance exceeds the passively constructed portfolio. Added value can be achieved by varying the index exposures over time or by security selection within the index universes.

For this method, the only data required are the total returns for the mutual funds and that of a set of passive indexes. These data are readily available on a timely basis and are objective and uniform, while timely mutual fund holdings can be difficult to obtain and can be exposed to managers window dressing risk. The basic idea is to consider that the return of a mutual fund represents the weighted average of a group of benchmarks. Thus:

$$\widetilde{R}_i = [b_{i1}\widetilde{F}_1 + b_{i2}\widetilde{F}_2 + \ldots + b_{in}\widetilde{F}_n] + e_i$$

where $\widetilde{R}_i$ represents the return on asset i, $\widetilde{F}_1$ represents the value of benchmark (or factor) 1, $\widetilde{F}_n$ represents the value of the last benchmark n, and e_i the non-benchmark component of the return on i. A key assumption of the model is that the non-benchmark return for one asset (e_i) is assumed to be uncorrelated with that of every other (e_j). In effect, the benchmarks are the only sources of correlation among returns.

In the model each factor represents the return on an asset class and the sensitivities (b_{ij} values) are required to sum to 1 (100%). The return on an asset i is represented as the return on a portfolio (shown by the sum of the terms in the bracketed expression) invested in the *n* asset classes plus a residual component (e_i). Sharpe calls the sum of the terms in the brackets the "return attributable to style" and the residual component (e_i) the "return due to selection". Indeed, a key contribution of this approach is the separation of return into these two main components. The goal of style analysis is to select the style (set of asset class exposures) that minimizes the variance of the difference between the fund's return and the style[6]. The model is evaluated on the basis of its ability to explain the return of the assets in question. A useful metrics is the proportion of variance "explained" by the n selected asset

[6] For the presence of non-linear constrains in the coefficients, we use a non-linear least square (NLLS) estimate.

classes[7]. We also computed the F test of linear restriction, to evaluate whether the exposures to style factors are always significantly different to zero.

One of the most essential elements in performing returns based style analysis is to use the appropriate benchmarks: ones that are comprehensive and yet mutually exclusive. If benchmarks are too highly correlated (not mutually exclusive), when the regression attempts to match the fund's return over a shorter time period, the factor weightings may oscillate between the two highly-correlated assets from period to period. Likewise, if the set of benchmarks is incomplete, when the regression attempts to match the fund's returns, it will have trouble pinning down a benchmark that consistently explains the fund's behaviour from period to period. The typical returns based style analysis uses a constrained regression, meaning that the sum of the benchmark exposures must equal 100%. Therefore, the model must find a fit with one of that benchmarks being used. If those benchmarks are inadequate, the regression is likely to flip-flop between those that temporarily provide a best fit and this fact will be reflected in a low R^2.

It is important to note that the style identified in such an analysis is, in a sense, an average of potentially changing styles over the period covered. It is helpful to examine the behaviour of a manager's average exposures to asset classes over time. To do so, one can perform a series of style analyses, using a fixed number of months for each analysis, rolling the window used for the analysis through time, this technique is known as rolling style chart and shows the changes in a mutual fund's style by graphing the output from a series of rolling period regressions.

Results from Style Analysis

We consider four benchmarks (or factors): a Growth index, a Value index, a Small Cap index and a free-risk return index (Bot): they are built by *Morgan Stanley Capital International* for the Italian market.

The first result we presented is the correlation between the indexes that are chosen as benchmarks, in order to avoid duplications of benchmarks. **Table 1** shows that the correlation between indexes is not so high, so there are no problems in benchmark duplication. The fact that funds belong to the same category is a useful indicator when selecting benchmarks,

[7] Using a traditional definition, for asset i: $R^2 = 1 - \frac{\mathrm{Var}(\tilde{e}_i)}{\mathrm{Var}(\tilde{R}_i)}$.

because it is possible to know the asset classes in which the money managers can invest, in this case, in particular, national equities and bonds.

Initially we estimate the coefficient on the whole sampling period of four years for each fund, in order to identify whether the asset allocation in the category is stable or whether there are different strategies. We then reduced the sampling period to one year to verify whether we can obtain a better fitting. This is done because we have funds in which the coefficient of the Bot is very high, perhaps because these funds have changed category over time and only at the end of the sample they result as equity funds.

To examine the behaviour of a manager's average exposure to asset classes over time we have built the Rolling Chart for each fund. In this way it is possible to observe that the coefficients change over time, as does the dynamic of the asset allocation.

The results confirm that the funds in our sample are homogeneous and thus the classification provided by Assogestioni can be considered coherent. The level of R^2 is always near 80%, except for only 7 funds and these funds, which have a different style from the others, are always the same even when the analysis is carried out for reduced sampling periods.

It is important to note that the mutual funds industry in Italy is very young, but it has achieved widespread support by investors, partly because of the unexpected and rapid growth of market's return. The mutual fund industry's response was a sort of "*emergency management*", based on pre-existing human and intellectual resources, in which the mutual fund manager followed the naive portfolio rebalancing. With the recent slowdown in the market growth, it is more difficult for money managers to add value, and so their strategies are developing very rapidly. Part of this change already occurred with the introduction of funds with innovative strategies, such as lifestyle funds, etc. Assogestioni cannot classify the funds into meaningful groups and so the return's based style analysis will be more relevant in the sorting of the funds. Finally, a return's based technique can be also used to launch of new products and to evaluate competitors in a new market segmentation.

Morningstar Risk-Adjusted Rating.

Morningstar incorporated calculates its own measures of risk-adjusted performance that form the basis of its popular star rating, which is routinely published by the *New York Times*. A recent study reported in both the *Boston Globe* and the *Wall Street Journal* points to the importance of the Morningstar star rating service. This study found that 97% of the money flowing into equity funds between January and August 1995 was invested in funds which

were rated as 5-star or 4-star funds by Morningstar, while funds with less than 3 stars suffered a net outflow of funds during the same period[8]. Moreover, the heavy use of Morningstar ratings in mutual fund advertising suggests that mutual fund companies believe that investors care about Morningstar ratings.

To calculate its ratings, Morningstar first classifies funds into one of four categories: Domestic Equity, Foreign Equity, Municipal Bond and Taxable Bond. The risk-adjusted return is calculated in the following manner. First they calculate a load-adjusted return for the fund by adjusting the returns for management fees and other costs, and then by adjusting for front-end and deferred loads. Next, they calculate a "Morningstar Return" in which they take the load-adjusted excess return divided by the higher of two variables: the excess average return of the fund category or the average 90-day U.S. T-bill rate:

$$Morningstar\ \ Return = \frac{Load\ \ Adjusted\ \ Return\ on\ the\ \ Fund - T\ Bill}{Higher\ \ of\ (Average\ \ Category\ \ Excess\ \ Return\ \ or\ \ T\ Bill)}$$

Morningstar divides through by one of these two variables to prevent distortions caused by having low or negative average excess returns in the denominator of equation.

Morningstar then calculates a "Morningstar Risk" measure. This measure is calculated differently from traditional risk measures, such as beta and standard deviation, which both see greater-than and less-than-expected returns as added volatility. Morningstar believes that for most investors their greatest fear is losing money, which they define as under performing the risk-free rate of return an investor can earn from the 90 day Treasury Bill. Hence, their risk measure only focuses on downside risk. To calculate the Morningstar risk, they plot the monthly returns in relation to T-bill returns. They add up the amounts by which the fund trails the T-Bill return each month, and then divide that total by the time horizon's total number of months. This number, the average monthly underperformance statistic, is then compared with those of other funds in the same broad investment category to assign the risk scores. The resultant Morningstar risk score expresses how risky the fund is relative to the average fund in its category:

$$MorningstarRisk = \frac{Fund's\ \ Average\ Underperformance}{Average\ Underperformance\ of\ \ its\ \ Category}$$

[8] Jaffe [1995]. The same survey was also reported by Damato [1996].

To calculate a fund's summary star-rating, the Morningstar Risk scores are then subtracted from the Morningstar Return scores. The resulting number is then plotted along a bell curve to determine the fund's star rating. If the fund scores in the top 10% of its broad investment category, it receives a rating of 5 stars; if the fund falls in the next 22.5% it receives 4 stars; if it falls in the middle 35% it receives 3 stars; if it lies in the next 22.5%the fund receives 2 stars, and if it is in the bottom 10% it receives 1 star. Stars are calculated for three, five and ten year periods and then combined into an overall ratings. Funds with a track record of less than three years are not rated.

Fig. 1. – The calculation subtracts each fund's Morningstar risk score from its Morningstar return score. The top 10% earn 5 stars, the next 22.5% get 4 stars, the middle 35% receive 3 stars, the next 22.5% get 2 stars and the last 10% receive only 1 star.

2.3. Risk adjusted measures based on Customized Benchmark

Managers take risk, and potentially add value, by deviating from the benchmark. They may hold fewer securities, and they may weigh them differently from their benchmark weights. They may buy and sell them at different times: in other words, they add value through security selection and market timing decisions.

Customized measures of risk are used to assess the historical magnitude of a portfolio's active bets (security selection, sector weighting, etc.) relative to a customized benchmark. Relative (or customized) measures of risk-adjusted returns are used to assess the portfolio manager's "skill" in making these bets, converting them into higher returns for the client. While the absolute measures described above are suitable for both active and passive portfolios, customized measures are suitable only for actively managed portfolios.

Italy is the first country in Europe where, by law, the customized benchmark (Assogestioni [2000]) must be contained in the mutual fund's prospectus and in its application. In this way the benchmark can be especially helpful to mutual fund investors by offering market "standards" to help them evaluate the risk and the return of their own

investments. In this sense, our work is the first analysis based on customized benchmarks for the Italian market.

The most widely-used measure of benchmark relative risk is *tracking error* (TE), which is the standard deviation of residual returns (i.e., of the difference between portfolio returns and benchmark returns, also called alpha). Generally, the higher the tracking error, the greater the relative bets the manager has taken (Lee [2000]).

Alphas and tracking errors depend on the aggressiveness factor as well as the skill of the manager. This feature makes it difficult to compare different managers. The fact that a manager's alpha is higher than those of other managers does not necessarily suggest that this manager has the best skill, as the manager may simply have the highest level of aggressiveness in making bets. As the level of aggressiveness increases, the distribution of alphas will also be more disperse, leading to an higher tracking error as well as higher alpha. To have a fair comparison of different managers, we need some measures which are aggressiveness independent. One such measure is the *information ratio* (IR), which is computed by dividing a portfolio's active return relative to the benchmark by its tracking error:

$$Information\ \ Ratio = \frac{Alpha}{Tracking\ \ Error}$$

The information ratio measures the quality of the manager's information discounted by the residual risk in the betting process (Goodwin [1998]).

Positive IRs indicate value added from active management, and thus the manager's skill. IRs, as mentioned above, allow comparison of managers with different levels of aggressiveness. Low relative return, low tracking risk managers can be considered to add just as much value as high relative return, high tracking risk managers with the same IR. The choice of an appropriate benchmark in calculating an IR is very important. Permanent "tilts" relative to a benchmark in calculating IR will distort calculations of risk. For example, a manager who always avoids technology stocks, or has a permanent small cap tilt, will have a portfolio that behaves differently from the benchmark. This results in mistracking unrelated to skill and in a distorted risk-return profile for the portfolio.

Instead of finding the portfolio with the smallest total return volatility for a given expected total return, current professional money managers must look at the portfolio with

minimum tracking error volatility[9] for a given expected performance relative to the benchmark. Contrary to traditional Mean-Variance efficiency (MV), it is called the TEV criterion: minimization of tracking error volatility for a given expected tracking error. This is a straightforward optimization problem that can be solved analytically when there are no short-selling constraints (Roll [1992]).

2.4. Results of performance analysis

Referring to performance evaluation, an interest topic is to appreciate correlation among different measures. In fact it is extremely interesting to verify whether various performance measures, with different characteristics, produce analogous rankings of funds. **Table 2**, which reports the rank order correlation measured by Spearman's coefficient[10], seems to indicate a very high correlation between the Sharpe, Sortino and Treynor ratios, whereas there exists only a weak relation between these measures and the information ratio, which appear as a substantially different measure from the others.

All volatility measures are calculated on the basis of an *exponentially moving average* of historical observations where the latest observations carry the highest weight in the volatility estimate. This approach has two important advantages over the equally weighted model. First, volatility reacts faster to shocks in the market because recent data carry more weight than data in the distant past. Second, following a shock (a large return), the volatility declines exponentially as the weight of the shock observation falls. In contrast, the use of a simple moving average leads to relatively abrupt changes in the standard deviation once the shock falls out of the measurement sample, which, in most cases, can be several months after it occurs. For a given set of T returns, the formula used to compute exponentially weighted (standard deviation) volatility[11] is:

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[9] It is possible to find two definitions of tracking error that in some studies is defined as the difference between the return on an active portfolio and the return on a benchmark portfolio, in other studies as the standard deviation of the previous difference.

[10] The statistics take on values between +1 and –1, where +1 indicates they are identical and –1 indicates the rankings are reversed. The Spearman's rank-correlation is computed using the following formula: $c = 1 - \frac{6\sum_{i=1}^{n}[r(X_i) - r(Y_i)^2]}{n(n^2 - 1)}$, where $r(X_i)$ is the rank of the i[th] fund using one performance measure; $r(Y_i)$ is the rank of the i[th] fund using a different performance measure; *n* number of funds being ranked.

[11] The *exponentially weighted moving average* model is a particular case of GARCH (1,1) model that can be written as: $\sigma_n^2 = \gamma V + \alpha u_{n-1}^2 + \beta \sigma_{n-1}^2$ where u_n is defined as the continuously compounded return for the

$$\sigma_\lambda = \sqrt{(1-\lambda)\sum_{t=1}^{T}\lambda^{T-t}(r_t - \bar{r})^2}$$

Notice that the exponentially weighted moving average depends on the parameter λ ($0 < \lambda < 1$), which is often referred to as the *decay factor*. This parameter determines the relative weights that are applied to the observations. We choose $\lambda = 0.94$, that is the optimal value found by RiskMetrics[12] for the equity market.

3. Persistence analysis

Several studies, such as Grinblatt and Titman [1992], Goetzmann and Ibbotson [1994] and Hendriks, Patel, Zeckhauser [1993] present strong evidence in favour of a "*hot hand*" phenomenon; that is, mutual funds that achieved above average returns continue to enjoy superior performance. It will be interesting to see whether we can confirm the findings of return persistence also in the Italian Market, whereas the previous literature on performance persistence has concentrated mainly on the U.S. funds, while only little evidence is available for Italy[13].

We follow the approach of Malkiel [1995], Brown & Goetzmann [1995] and Agarwal & Naik [2000] to determine the extent of persistence in the performance of mutual fund managers, examining the persistence of performance measures, mentioned above, in the traditional two-period framework using non-parametric tests based on contingency tables. We compare the performance measures in the current period on the performance measures in the previous period. In particular, at every date, we considered all the funds that were active at the end of previous interval and we construct a contingency table of winners and losers where a fund is a *winner* if the performance measure of that fund is greater than the median performance measure of all the funds in that period, otherwise it is a *loser*. Persistence in this context relates to the funds that are winners in two consecutive periods (weekly) denoted by *WW*, or losers in two consecutive periods, denoted by *LL*. Similarly, winners in the first period and losers in the second period are denoted by *WL*, and *LW* denotes the reverse. In

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period *n* and σ_n^2 is the estimate of the variance rate for period n. The *EWMA* model is a particular case of *GARCH(1,1)* where $\gamma = 0$, $\alpha = 1 - \lambda$ and $\beta = \lambda$, see Hull [2000].

[12] J.P.Morgan/Reuters, Riskmetrics: "Statistics of Financial Market Returns", Technical Document New York, 1996.

this framework, we use both *Cross-product ratio* (CPR) and *Chi-square statistic* to detect persistence. CPR, defined as $\frac{WW \times LL}{WL \times LW}$, captures the ratio of the funds which show persistence in performance to the ones which do not. The null hypothesis in this setting represents lack of persistence for which the CPR equals one. In other words, when there is no persistence, one would expect each of the four categories denoted by WW, WL, LW and LL to have 25% of the total number of funds. We determine the statistical significance of the CPR by using the standard error of the natural logarithm of the CPR given by (see Christensen [1990]):

$$\sigma_{\ln(CPR)} = \sqrt{\frac{1}{WW} + \frac{1}{WL} + \frac{1}{LW} + \frac{1}{LL}}$$

In fact, it is possible to demonstrate that the statistic $Z = \frac{\ln(CPR)}{\sigma_{\ln(CPR)}}$ is normally distributed.

We also conduct a Chi-square test comparing the observed frequency distribution of WW, WL, LW and LL for each fund with the expected frequency distribution. In a recent paper, Carpenter and Lynch [1999] study the specification and power of various persistence tests. They find that the Chi-square test based on the number of winners and losers is well specified, powerful and more robust to the presence of survivorship bias compared to other test methodologies. We compute the Chi-square statistic as:

$$\chi^2 = \frac{(WW - D1)^2}{N} + \frac{(WL - D2)^2}{N} + \frac{(LW - D3)^2}{N} + \frac{(LL - D4)^2}{N}$$

where:

$$D1 = \frac{(WW_T + WL_T) * (WW_T + LW_T)}{N} \qquad D2 = \frac{(WW_T + WL_T) * (WL_T + LL_T)}{N}$$

$$D3 = \frac{(LW_T + LL_T) * (WW_T + LW_T)}{N} \qquad D4 = \frac{(LW_T + LL_T) * (WL_T + LL_T)}{N}$$

[13] Casarin., Pellizzon, Piva [2000]; Beltratti, Miraglia[2001].

Subscript T indicates that the number of funds to put in the formula is the theoretical one, under null hypothesis that represents lack of persistence. This statistic, also known as Pearson's statistic, follows a χ^2 distribution with one degree of freedom. We also performed these two tests by modifying the concept of winner, defining in this way only those funds that exceeded the 75th percentile return.

Results of persistence analysis

Our results suggest that mutual fund investors can benefit from choosing funds based on past risk-adjusted performance. The results of CPR and chi-square tests confirm the existence of the "hot hand phenomenon" for Italian equity mutual funds. The contingence tables for Sharpe, Treynor and Sortino Ratio are very similar for both the definitions of winner. The measure which generates more persistence is the Morningstar Risk Adjusted one, as results by p-value of the chi-square test in **Table 6**.

The persistence analysis of information ratio presents a contradictory behaviour, the CPR confirms the presence of persistence, whereas for chi-square test the null hypothesis cannot be rejected. This is due to the fact that IR considers the difference between funds returns and customized benchmarks, and this measure orders the funds in a less stable way. We observe that when we consider winner only those funds that exceeded the 75th percentile return, we find persistence with a higher level of confidence. Therefore, the winning class in this case is more stable than the previous one and consequently there exists a little group of funds that methodically produces better returns and is always at the top of the ranking. When we consider the first winning criterion we included in this class also funds that change rank position very frequently, and so we find less evidence of persistence. In this market only few fund managers are able to persistently beat the competitors and to demonstrate superior skill, and for this reason when we restrict the winning criterion we find more evidence of persistence. Performance persistence results are related to the performance indicator and for this reason it is important to analyse this phenomenon with several indicators, that present different characteristics.

4. Conclusion

This paper investigates the extent of performance persistence exhibited by Italian equity mutual funds from January 1997 to December 2000 using the traditional two-period framework. It also examines whether the persistence observed is sensitive to the performance measures used and to the winning criterion. We also compared the fund ranking procedure produced by all risk-adjusted performance measures and above all the ranking produced by the Morningstar ones. We know from Brown et al.[1999] that the existence of "style factors" can lead to reversals in the persistence phenomenon because of the differences in the levels of systematic risk across managers. We therefore use return-based style analysis to evaluate the homogeneity of our sample.

We found three interesting patterns. First, There exists a very high correlation between performance measures based on absolute benchmarks; on the contrary There is only a weak relation between these measures and the information ratio. The *Morningstar Risk Adjusted measure* seems to produce different results from other performance measures, especially in terms of the persistence evaluation. Second, there exists a considerable amount of persistence, above all when we consider as winning criterion the returns that exceeded the 75th percentiles. Finally, the Assogestioni classification for Italian equity funds is coherent because returns-based style analysis confirms that no further groups, having an explanatory power, may be identified.

The results of this paper lead to two clear implications. First, because of the increasing complexity of the mutual funds market it may be useful to introduce a rating systems, like the Morningstar's one, based on peer group comparison for the Italian funds. Second, this paper has documented that the ranking of the funds, and so the persistence level, are related to the performance indicator chosen. We find the Morningstar measure generates the highest level of persistence. Therefore we analyzed several in order to extract useful information from the data: "We do not yet have all the pieces of the portfolio management puzzle. Even more reason to use all of the pieces we do have[14]".

It is important to bear in mind that the Italian mutual funds industry is very young but it has achieved widespread support by investors. Evaluating money managers able to generate "extra-return" will be more difficult with the development of the industry. Rating systems, persistence analysis and returns-based approaches are useful instruments for funds selection, topics that will need more attention in the field of investment management.

[14]Sortino, Forsey [1996].

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Table 1. – Correlation among indexes chosen as benchmarks.

	GROWTH	VALUE	SMALLCAPS	BOT
Growth	1	0.630135	0.507334	0.010653
Value		1	0.662999	0.134662
Small-Caps			1	0.059575
Bot				1

Table 2. – Sperman's rank order correlation coefficient.

	SHARPE	SORTINO	TREYNOR	MORNINGSTAR	INFORMATION
Sharpe	1.00	0.95	0.95	0.90	0.56
Sortino		1.00	0.93	0.90	0.54
Treynor			1.00	0.90	0.55
Morningstar				1.00	0.57
Information					1.00

Table 3. – Styles of different funds.

N°	FUNDS	T/D	N° OBS.	GROWTH	VALUE	SMALL	BOT	R^2
1	Alberto Primo Re	D	114	0.2433 (0.000)*	0.0001 (0.317)	0.4083 (0.000)*	0.3483 (0.000)*	0.4897
2	Alboino Re	D	61	0.5650 (0.000)*	0.0000 (1.000)	0.4349 (0.000)*	0.0000 (0.920)	0.5149
3	Apulia Azionario	A	207	0.3691 (0.000)*	0.0749 (0.000)*	0.3552 (0.000)*	0.2008 (0.000)*	0.7984
4	Arca Azioni Italia	A	207	0.3438 (0.000)*	0.1305 (0.000)*	0.3870 (0.000)*	0.1388 (0.000)*	0.8172
5	Aureo Previdenza	A	207	0.3429 (0.000)*	0.1262 (0.000)*	0.3534 (0.000)*	0.1775 (0.000)*	0.7971
6	Azimut Crescita It.	A	207	0.4444 (0.000)*	0.0128 (0.000)*	0.4683 (0.000)*	0.0745 (0.000)*	0.7823
7	Bipiemme Italia	A	207	0.3788 (0.000)*	0.0756 (0.000)*	0.4754 (0.000)*	0.0702 (0.000)*	0.8034
8	Bluecis	D	179	0.4171 (0.000)*	0.0069 (0.000)*	0.3817 (0.000)*	0.1943 (0.000)*	0.7598
9	Bn Azioni Italia	A	207	0.3540 (0.000)*	0.1426 (0.000)*	0.3896 (0.000)*	0.1138 (0.000)*	0.7810
10	Bpb Tiziano	A	207	0.3429 (0.000)*	0.1198 (0.000)*	0.3923 (0.000)*	0.1451 (0.000)*	0.8216
11	Capitalgest Italia	A	207	0.3502 (0.000)*	0.1248 (0.000)*	0.4226 (0.000)*	0.1025 (0.000)*	0.8174
12	Carifondo Azioni It.	D	203	0.3943 (0.000)*	0.0471 (0.000)*	0.4068 (0.000)*	0.1519 (0.000)*	0.7923
13	Centrale Italia	A	207	0.4069 (0.000)*	0.0910 (0.000)*	0.4038 (0.000)*	0.0983 (0.000)*	0.7852
14	Cisalpino Indice	A	207	0.4601 (0.000)*	0.0838 (0.000)*	0.4421 (0.000)*	0.0140 (0.000)*	0.7853
15	Cliam Azioni Italiane	A	207	0.4038 (0.000)*	0.0515 (0.000)*	0.4422 (0.000)*	0.1025 (0.000)*	0.7721
16	Comit Azione	A	207	0.3151 (0.000)*	0.0001 (0.709)	0.3709 (0.000)*	0.3140 (0.000)*	0.3849
17	Comit Azioni Italia	D	207	0.2509 (0.000)*	0.2196 (0.000)*	0.3794 (0.000)*	0.1501 (0.000)*	0.8176
18	Credis Azionario It.	D	207	0.3411 (0.000)*	0.1889 (0.000)*	0.3741 (0.000)*	0.0959 (0.000)*	0.8105
19	Ducato Azionario It.	A	207	0.4849 (0.000)*	0.0000 (0.000)*	0.5151 (0.000)*	0.0000 (0.058)	0.7741
20	Effe Azionario Italia	D	146	0.3477 (0.000)*	0.1261 (0.000)*	0.4104 (0.000)*	0.1158 (0.000)*	0.7834
21	Epta Azioni Italia	A	207	0.4468 (0.000)*	0.0511 (0.000)*	0.4661 (0.000)*	0.0360 (0.000)*	0.8010
22	Euroconsult. Zecchino	A	207	0.3953 (0.656)	0.1547 (0.000)*	0.4200 (0.000)*	0.0300 (0.000)*	0.7816
23	Euromob Azioni It.	A	207	0.3709 (0.000)*	0.0776 (0.000)*	0.4146 (0.000)*	0.1370 (0.000)*	0.7528
24	F&F Gestione Italia	A	207	0.3394 (0.000)*	0.1563 (0.000)*	0.4054 (0.000)*	0.0989 (0.000)*	0.8071
25	F&F Select Italia	A	207	0.3310 (0.000)*	0.1007 (0.000)*	0.4537 (0.000)*	0.1146 (0.000)*	0.8199

T/D indicates if the dividends of the fund are reinvested in the fund (A) or given to its investors (D); in this second case, the return of the fund is calculated on the basis of a total return index that calculates the performance assuming that all dividends and distributions are reinvested.
The *p*-value of *F*-test for each coefficient is reported in brackets.
* significant at the 5% level.

Table 3. – Styles of different funds (continued)

N°	FUNDS	T/D	N° OBS.	GROWTH	VALUE	SMALL	BOT	R^2
26	Fondersel Italia	A	207	0.3468 (0.000)*	0.1559 (0.000)*	0.4688 (0.000)*	0.0284 (0.000)*	0.7968
27	Fondersel Piccole e M.I.	A	207	0.1467 (0.000)*	0.0222 (0.000)*	0.6040 (0.000)*	0.2272 (0.000)*	0.8100
28	Fondicri Selezione Italia	A	207	0.3741 (0.000)*	0.1062 (0.000)*	0.4313 (0.000)*	0.0883 (0.000)*	0.7872
29	Fondinvest Piazza Affari	A	207	0.3677 (0.000)*	0.1161 (0.000)*	0.4028 (0.000)*	0.1134 (0.000)*	0.8134
30	Fonditalia Equity Italy	A	207	0.4150 (0.000)*	0.1934 (0.000)*	0.3637 (0.000)*	0.0279 (0.000)*	0.8096
31	Gepocapital	A	207	0.2844 (0.000)*	0.1336 (0.000)*	0.3796 (0.000)*	0.2024 (0.000)*	0.8237
32	Gesticredit Borsa Italia	A	207	0.3833 (0.000)*	0.0992 (0.000)*	0.4086 (0.000)*	0.1089 (0.000)*	0.8009
33	Gesticredit Crescita	D	197	0.3801 (0.000)*	0.0765 (0.000)*	0.4588 (0.000)*	0.0845 (0.000)*	0.7770
34	Gestielle A	A	207	0.3919 (0.000)*	0.0804 (0.000)*	0.5072 (0.000)*	0.0204 (0.000)*	0.7631
35	Gestifondi Az Italia	D	207	0.3788 (0.000)*	0.1170 (0.000)*	0.4633 (0.000)*	0.0408 (0.000)*	0.7945
36	Gestnord Piazza Affari	D	207	0.3653 (0.000)*	0.1370 (0.000)*	0.3727 (0.000)*	0.1250 (0.000)*	0.8168
37	Grifoglobal	A	207	0.3112 (0.000)*	0.1045 (0.000)*	0.3992 (0.000)*	0.1852 (0.000)*	0.7976
38	Imi-Italy	A	207	0.3634 (0.000)*	0.1879 (0.000)*	0.4008 (0.000)*	0.0479 (0.000)*	0.8226
39	Ing Azionario	A	207	0.4136 (0.000)*	0.1159 (0.000)*	0.4362 (0.000)*	0.0343 (0.000)*	0.7896
40	Interfund Italy Equity	D	187	0.4195 (0.000)*	0.2068 (0.000)*	0.3358 (0.000)*	0.0378 (0.000)*	0.8051
41	Investire Azionario	A	207	0.3660 (0.000)*	0.1146 (0.000)*	0.4238 (0.000)*	0.0956 (0.000)*	0.8119
42	Italfortune A	D	207	0.0329 (0.000)*	0.0470 (0.000)*	0.4543 (0.000)*	0.4659 (0.000)*	0.2058
43	Italy Stock Management	A	207	0.3519 (0.000)*	0.0872 (0.000)*	0.4075 (0.000)*	0.1534 (0.000)*	0.7502
44	Leonardo Azioni Italia	D	109	0.3757 (0.000)*	0.0001 (0.656)	0.5256 (0.000)*	0.0986 (0.000)*	0.5085
45	Leonardo Small Caps	D	109	0.3255 (0.000)*	0.0000 (0.664)	0.5469 (0.000)*	0.1275 (0.000)*	0.4277
46	Mediceo Indice Italia	D	207	0.3696 (0.000)*	0.1134 (0.000)*	0.4229 (0.000)*	0.0941 (0.000)*	0.7957
47	Mida Azionario	D	207	0.4276 (0.000)*	0.0714 (0.000)*	0.4961 (0.000)*	0.0049 (0.000)*	0.7727
48	Oasi Azionario Italia	D	207	0.3726 (0.000)*	0.1490 (0.000)*	0.3989 (0.000)*	0.0795 (0.000)*	0.8168
49	Oasi Crescita Azionario	A	207	0.3970 (0.000)*	0.0717 (0.000)*	0.4649 (0.000)*	0.0665 (0.000)*	0.7539
50	Oasi Italian Equity Risk	A	207	0.4004 (0.000)*	0.0770 (0.000)*	0.4701 (0.000)*	0.0526 (0.000)*	0.7965

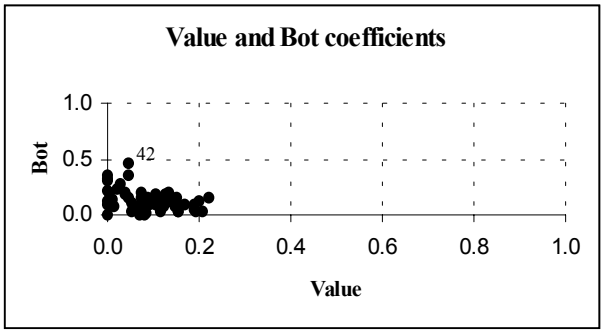
T/D indicates if the dividends of the fund are reinvested in the fund (A) or given to its investors (D); in this second case, the return of the fund is calculated on the basis of a total return index that calculates the performance assuming that all dividends and distributions are reinvested.
The *p*-value of *F*-test for each coefficient is reported in brackets.
* significant at the 5% level.

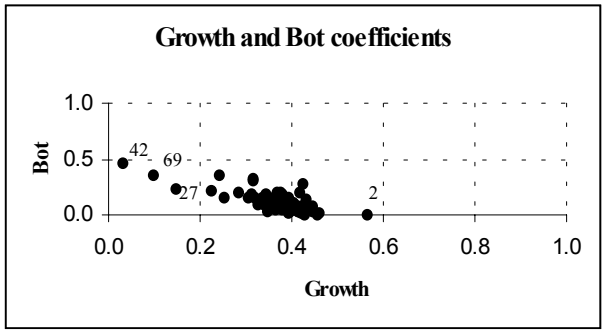
Table 3. – Styles of different funds (continued)

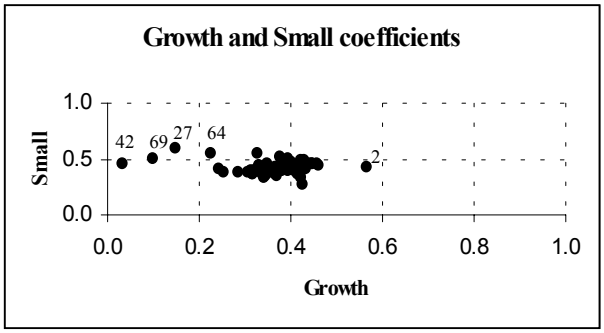
N°	FUNDS	T/D	N° OBS.	GROWTH	VALUE	SMALL	BOT	R^2
51	Oltremare Azionario	A	207	0.4395 (0.000)*	0.0610 (0.000)*	0.4592 (0.000)*	0.0403 (0.000)*	0.7962
52	Optima Azionario	D	108	0.4248 (0.000)*	0.0297 (0.000)*	0.2695 (0.000)*	0.2760 (0.000)*	0.7161
53	Padano Indice Italia	A	207	0.4222 (0.000)*	0.1215 (0.000)*	0.3858 (0.000)*	0.0706 (0.000)*	0.7977
54	Prime Capital	D	207	0.4317 (0.000)*	0.0121 (0.000)*	0.4216 (0.000)*	0.1346 (0.000)*	0.7795
55	Prime Italy	A	207	0.4295 (0.000)*	0.0619 (0.000)*	0.4262 (0.000)*	0.0824 (0.000)*	0.7933
56	Primeclub Azionario It.	D	207	0.4276 (0.000)*	0.0564 (0.000)*	0.4356 (0.000)*	0.0804 (0.000)*	0.7942
57	Quadrifoglio bluechips	D	147	0.3807 (0.000)*	0.0397 (0.000)*	0.3939 (0.000)*	0.1858 (0.000)*	0.7777
58	Ras Capital	A	207	0.3273 (0.000)*	0.1693 (0.000)*	0.4164 (0.000)*	0.0869 (0.000)*	0.8018
59	Ras Piazza Affari	D	167	0.3379 (0.000)*	0.1263 (0.000)*	0.3930 (0.000)*	0.1429 (0.000)*	0.7822
60	Risparmio It.Crescita	A	207	0.3969 (0.000)*	0.0844 (0.000)*	0.4206 (0.000)*	0.0981 (0.000)*	0.8032
61	Roloitaly	A	207	0.3796 (0.000)*	0.0738 (0.000)*	0.3927 (0.000)*	0.1539 (0.000)*	0.8003
62	Romagest Azionario It.	D	207	0.3718 (0.000)*	0.0841 (0.000)*	0.4374 (0.000)*	0.1066 (0.000)*	0.7883
63	Romv.Ita.Eq. Index	D	207	0.3403 (0.000)*	0.2016 (0.000)*	0.3407 (0.000)*	0.1174 (0.000)*	0.8112
64	Royal&Sunal.Smallcaps	A	207	0.2237 (0.000)*	0.0000 (0.171)	0.5614 (0.000)*	0.2149 (0.000)*	0.7457
65	Sai Italia	A	207	0.3198 (0.000)*	0.1258 (0.000)*	0.4066 (0.000)*	0.1478 (0.000)*	0.7711
66	Sanpaolo Azioni Italia	A	207	0.4203 (0.000)*	0.0691 (0.000)*	0.4903 (0.000)*	0.0204 (0.000)*	0.7393
67	Symphonia Azionario It.	D	205	0.3748 (0.000)*	0.0382 (0.000)*	0.3934 (0.000)*	0.1937 (0.000)*	0.7417
68	Venetoblue	A	207	0.3045 (0.000)*	0.1507 (0.000)*	0.3899 (0.000)*	0.1549 (0.000)*	0.7911
69	Venetoventure	A	207	0.0969 (0.000)*	0.0460 (0.000)*	0.5027 (0.000)*	0.3544 (0.000)*	0.7707
70	Zenit Azionario	A	207	0.3159 (0.000)*	0.0003 (0.639)	0.3645 (0.000)*	0.3193 (0.000)*	0.4454
71	Zeta Azionario	A	207	0.3380 (0.000)*	0.1391 (0.000)*	0.3647 (0.000)*	0.1583 (0.000)*	0.8221

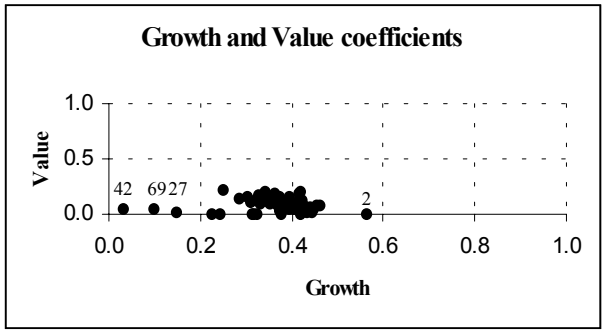
T/D indicates if the dividends of the fund are reinvested in the fund (A) or given to its investors (D); in this second case, the return of the fund is calculated on the basis of a total return index that calculates the performance assuming that all dividends and distributions are reinvested.
The *p*-value of *F*-test for each coefficient is reported in brackets.
* significant at the 5% level.

Table 4. – Style dimension



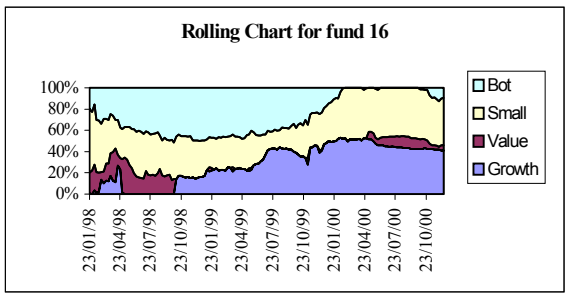


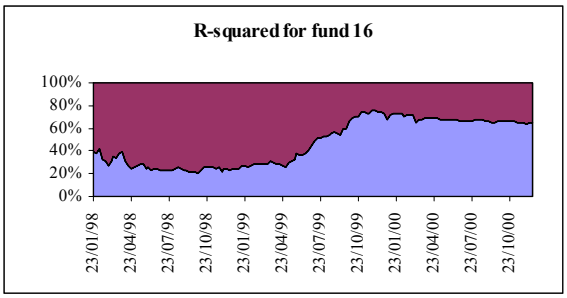


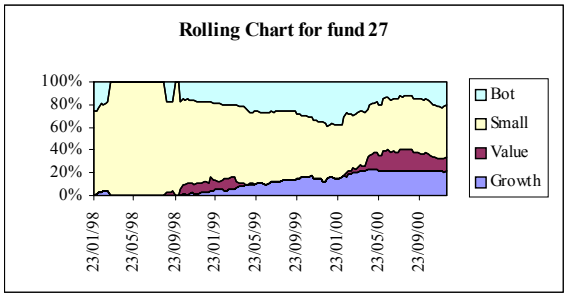


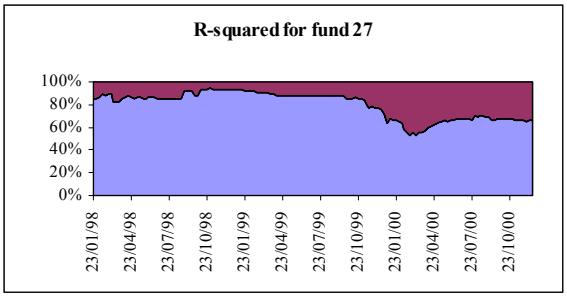
In these figures it is possible to evaluate the homogeneity of our sample: there exists only few funds that have a style analysis different from the others, that are indicated with the numbers. These graphs demonstrate that the Assogestioni classification for Italian equity funds is coherent because no further groups, having an explanatory power, may be identify.

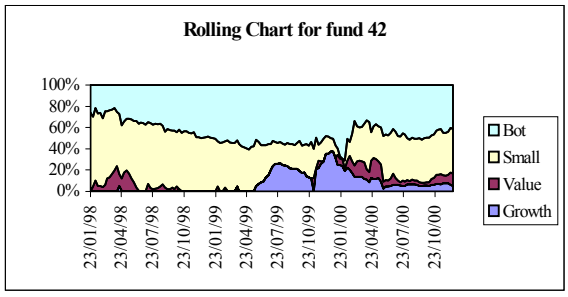
Table 5. – Relevant Rolling Charts

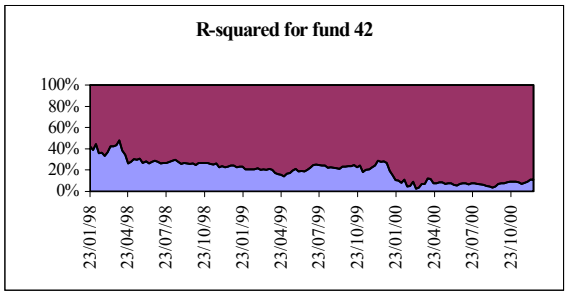


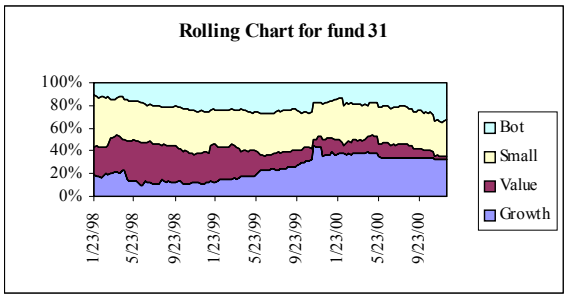


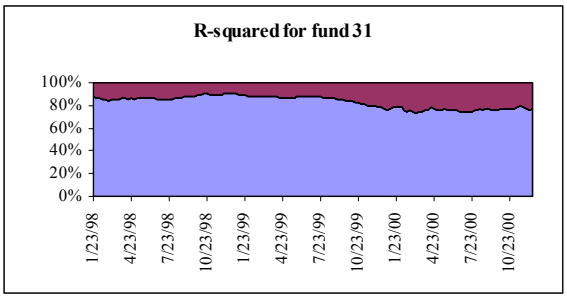












These are the Rolling Charts (or Distribution Area Graphs) of some particular funds. Fund 42 has the lowest R^2 of any mutual fund that we analyzed. In this case style analysis shows that this is a unique fund that is not easily pigeonholed according to traditional benchmarks. On the contrary fund 31 has the highest level of R^2 and the style of this fund represents a proper approximation of the style of the major part of the funds in the sample. Rolling chart of fund 27 shows that the fund is mostly exposed to small capitalization benchmark, whereas fund 16 changes the style during the sample period, and only in the second part of its history its style appears similar to the others, as we can see by the increasing in R^2.

Table 6. –Two period performance persistence analysis

	N° Funds	WW	LL	WL	LW	CPR	Z-Statistic	Chi-Squared	P-Value
Sharpe	2932	783	800	676	673	1.377	4.315**	4.719	0.029*
Sortino	2932	789	805	670	668	1.419	4.720**	5.632	0.017*
Treynor	2932	783	801	676	672	1.381	4.352**	4.807	0.028*
Morningstar	2932	883	900	576	573	2.408	11.614**	34.324	0.000**
Information	2776	715	747	660	654	1237	2.801**	2.163	0.142

Winners and losers are defined respect to **median return**;
" * " indicates 5% significance whereas " ** " indicates 1% significance.
"WW" indicates the number of persistence cases on "winners"; "LL" indicates the number of persistence cases on "losers"; "LW" and "WL" express the number of reversal cases, respectively from "losers" to "winner" and from "winner" to "losers". "CPR" expresses the value of "Cross-Product Ratio"; Z-statistic indicates the value of statistic test on "CPR"; " χ^2 " indicates the value of this test and "p-value" refers to χ^2 test. We perform these tests at every month (not reported because of limited space) and at the end of the evaluation period by summing between various date: the number of the funds used in calculating information ratio is different from the others because some customized benchmarks are not available at the beginning of the sample period.

	N° Funds	WW	LL	WL	LW	CPR	Z-Statistic	Chi-Squared	P-Value
Sharpe	2932	244	1757	468	463	1978	7.207**	10.064	0.002*
Sortino	2932	265	1778	447	442	2385	9.246**	15.493	0.000**
Treynor	2932	255	1768	457	452	2183	8.279**	12.758	0.000**
Morningstar	2932	282	1752	430	425	2.703	10.871**	18.169	0.000**
Information	2776	193	1634	479	472	1395	3.328**	3.460	0.063

Winners and losers are defined respect to **75th return**;
" * " indicates 5% significance whereas " ** " indicates 1% significance.
"WW" indicates the number of persistence cases on "winners"; "LL" indicates the number of persistence cases on "losers"; "LW" and "WL" express the number of reversal cases, respectively from "losers" to "winner" and from "winner" to "losers". "CPR" expresses the value of "Cross-Product Ratio"; Z-statistic indicates the value of statistic test on "CPR"; " χ^2 " indicates the value of this test and "p-value" refers to χ^2 test. We perform these tests at every month (not reported because of limited space) and at the end of the evaluation period by summing between various date: the number of the funds used in calculating information ratio is different from the others because some customized benchmarks are not available at the beginning of the sample period.