

1 Introduction

This paper analyzes and discusses the motivations of the profitability of momentum strategies in US market. In particular, we investigate and examine the factors that influence momentum profits. Doing so, we distinguish the main fundamental, macroeconomic and statistical variables which have an impact on momentum strategies based on optimal performance ratios (see Biglova, et al (2004b)).

Several empirical studies have shown that stocks with high returns over the past three to twelve months continue to perform well in future periods. Any momentum strategy is based on a mechanistic decision criterion for evaluating and ranking the stock performance. For example, Jagadeesh and Titman (1993) and Grundy and Martin (2001), use the cumulative return as criterion for ranking stocks into winner and loser portfolios. Alternatively to these analyses we apply performance ratios in the ranking process as shown by Biglova et al. (2004b). Since abnormal returns can be considered only if we assume that return distributions present heavy tails, the ranking criteria should consider the possibility that the return could have infinite variance. Therefore, our strategies use the performance ratios introduced in Biglova, et al (2004a), that are also applicable in the case of stable distributed returns (with finite mean) as criteria for constructing winner and loser portfolios. On the other hand, the existence of momentum strategies, based on the Rachev performance ratio have been empirically proved (see Biglova et al. (2004b)).

The contrasting interpretations of the possible causes of momentum effect have generated a heated debate in the recent literature (see Jagadeesh and Titman (1993), Rouwenhorst (1998) Griffin, et al. (2003)). A first justification given by Kahneman and Tversky (1982) and De Bondt and Thaler (1985) was based on market participants overreaction to information. However, Jegadeesh and Titman (1993) and others have shown that this motivation is insufficient to justify properly the higher returns achieved in momentum strategies. Moreover neither Fama and French (1996) or Chordia and Shivakumar (2002) multi-factor models (used to mimick portfolio returns), or the conditional CAPM (see Lewellen and Nagel (2004)) could explain the abnormal momentum returns.

In this paper, we investigate the major sources of momentum profits. Therefore first we determine the momentum profits with the Rachev ratio performance criterion applied at the components of the S&P500. To test which factors influence momentum profits, we examine the factors of the spread of the winner and loser portfolios. In particular we try to identify how momentum returns are related to fundamental, country-specific macroeconomic, and statistic factors. Finally we interpret those factors that better explain abnormal returns.

The remainder of the paper is organized as follows: Section 2 provides a brief description of the data and methodology and examines the profitability of momentum strategies. Section 3 provides an analysis of factors, that have an influence on momentum profits and Section 4 concludes the paper.

2 Algorithm of Momentum Strategies

In momentum strategies, there are the following three main decision steps (1) the length of the ranking or formation period, (2) the length of the holding or investment period, and (3) the ranking criterion. The strategy consists in selling losers and buying winners assets at the end of the ranking period and assessing their performance over the holding period. Biglova et al. (2004b) have shown that we obtain optimal length of the ranking period and holding period with “6-month/6-month” momentum strategy (also defined 6/6 strategy). This strategy involves evaluating returns over the past 6-months and holding the position for the next 6 months. Thus we first determine winners and losers based on prior returns in the ranking period, then the zero-investment, self-financing strategy generates momentum profits in the holding period. In particular, Bris et al. (2004) have shown that such zero-investment strategy is applicable in international equity investment management practice.

2.1 Description of the Data and Methodology

Usually in the momentum strategies literature, the stocks are ranked in ascending order. “Winners” are those stocks with the top 10% ranking-period returns and “losers” are those stocks with the lowest 10% ranking-period returns. Optimal winner and loser portfolios at formation are constructed and held for 6 months (the holding period). During the holding period, these portfolios are not rebalanced.

We consider all the stocks included in the S&P500 index over the 12-year time period from January 1992 to December 2003. Over that time period, there were more than 800 companies included in the index. However, we apply momentum strategies only on those companies that had a complete return history (3,026 observations). Therefore we have not included many of the components of the S&P500 index since they have shorter historical series with unequal histories. For the risk-free asset, we use daily observations of the one-month London interbank offered rate (US\$ Libor). We use daily log returns $r_t^i = \ln((S_t^i + D_{[t-1,t]}^i)/S_{t-1}^i)$ $i=0, \dots, N$; $t=1, \dots, T$ where S_t^i is the i -th stock price at time t , $D_{[t-1,t]}^i$ is the dividend on i -th asset during the period $[t-1, t]$, and r_t^0 is the risk-free log return valued at time t . Our procedure for implementation of momentum strategy is briefly summarized here below.

Step 1. Consider the matrix of excess returns $ER = [a_{i,j}]$ where $a_{i,j} = r_t^j - r_t^i$ is the i -th observation of the excess return ($i=1, \dots, T$ observations) on the j -th asset ($j=1, \dots, N$ assets)

Step 2. Divide the data into sub-periods equal to the length of the formation period. Compute the ranking ratio for each stock based on observations in this period and rank the stocks. The 10% of stocks with the highest ratio values will constitute winner portfolio, and the 10% stocks with the lowest ratio will form the loser portfolio.

Step 3. Form the zero-investment portfolios of winners and losers at the end of each formation period of 6-months (taking a long position in the winner top

decile portfolio and a short position in the bottom loser decile portfolio).

Step 4. Evaluate the performance of the winner and loser portfolios and of the zero-cost strategy at the end of each holding period taking into account the transaction costs.

2.2 Risk-Adjusted Criteria for Stock Ranking

In constructing a momentum portfolio, first we have to specify the criteria for forming a winner and loser portfolios. In previous studies the winners were those stocks with the highest past cumulative monthly returns over some ranking period (e.g., six-month monthly return for the six-month ranking period). Clearly this selection criterion does not consider the riskiness and the distributional behavior of the stock in the ranking period. Since abnormal returns can be considered only assuming heavy tailed return distributions, it would be more appropriate to develop a selection criterion applicable to non-Gaussian distributed asset returns. For example, stable non Gaussian distributions are fat-tailed and they do not admit finite variance even if they satisfy many of the properties of a Gaussian law. Moreover, stable distributions have been used to model both the unconditional and conditional returns, as well as theoretical framework of portfolio theory and market equilibrium models (see Rachev (2003)).

2.2.1 Alternative Risk Measures and Risk-Return Ratios

In the last years, several alternative measures have been proposed and used in portfolio theory to capture non-normality of asset returns (see Rachev et al (2008a) and the reference therein). Among these we recall a coherent risk measure, called Expected Tail Loss (ETL), also known as Total Value at Risk, Expected Shortfall, Conditional Value-at-Risk (CVaR) , is defined as

$$ETL_{\alpha}(X) = \frac{1}{\alpha} \int_0^{\alpha} VaR_q(X) dq,$$

where $VaR_q(X) = -F_X^{-1}(q) = -\inf \{x | P(X \leq x) > q\}$ is the Value-at-Risk (VaR) of the random return X . If we assume a continuous distribution for the probability law of X , then $ETL_{\alpha}(X) = -E(X | X \leq -VaR_{\alpha}(X))$ and thus, ETL can be interpreted as the average loss beyond VaR, see Rachev et al. (2008a). Expected tail loss conveys the information about the expected size of a loss exceeding VaR. For example, suppose that a portfolio's risk is calculated through the simulation. For 1,000 simulations and $\alpha = 0.95$, the portfolio's VaR would be the smallest of the 50 largest losses. The corresponding expected shortfall would be then estimated by the numerical average of these 50 largest losses.

These alternative risk-return performance measures can be used as criterion in forming momentum portfolios. One of these ratios is the Rachev ratio (denoted by R- ratio). This ratio with parameters α and β is defined as:

$$RR(\alpha, \beta) := RR_{(\alpha, \beta)}(r) := \frac{ETL_{\alpha 100\%}(r_f - r)}{ETL_{\beta 100\%}(r - r_f)},$$

where α and β are in $[0,1]$. Here, r denotes the return of a portfolio or asset over the given time horizon. The R-ratio is applied for different parameters α and β . The parameters α and β cover different significance levels of the right and left tail distribution, respectively. As observed by Rachev et al. (2008) investors that maximize the R-ratio prefer more than less and they are neither risk averse nor risk lover investors. The use of the R-ratio is largely justified by the investors behavior. As a matter of fact several empirical analyses have shown that investors who maximize this ratio increase their final wealth much more than using other performance ratios (see Biglova, et al (2004a)).

Biglova, et al (2004a) analyzed and compared the traditional Sharpe ratio (Sharpe (1994)) with alternative R-ratios for various parameter values that define different level of coverage of the tail of the distribution, demonstrating that statistical arbitrage approach based on alternative criterion generates more profitable momentum strategies than those based on the conventional cumulative or total return criterion. Results of that study are robust to transaction costs for both equal-weighted and optimized-weighted strategies. In particular, they find that empirically alternative R ratios outperform the cumulative return and the Sharpe ratio across all momentum strategies that they investigated, and measured by total realized return and independent performance measures over the observed period.

2.3 Optimization of Winner and Loser Portfolios Based on Risk-Return Criteria

Let us summarize our risk-adjusted criteria for construction of momentum strategies. First we identify winners and losers among the extreme deciles of stocks in S&P500 ordered with respect to the risk-return ratio measure. At any rebalancing time point , we solve two optimization problems where we still use the R-ratio as an objective function in the optimization. In particular, we maximize among the winners the R-ratio with α and β both equal to 0.05 and we minimize among the losers the same R-ratio. We choose these α and β since the empirical evidence has shown the possibility of momentum strategies for these values (see Biglova et al. (2004b)). Therefore, for any risk-return criterion, we can compute the optimal winner portfolio from the following optimization problem:

$$\begin{aligned} & \max_x RR_{(0.05, 0.05)}(x' r) \\ & \text{subject to} \\ & \sum_{i=1}^n x_i = 1; x_i \geq 0; i = 1, \dots, n \end{aligned} \tag{1}$$

and the following optimization problem to determine the loser portfolio:

