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Momentum and contrarian strategies in Eurozone futures markets

Abstract

Momentum and contrarian trading strategies have been tested extensively on equity markets around the world. In the present paper, we broaden the research horizon to futures markets, particularly those of the Eurozone, which are well suited to the implementation of similar strategies, thanks to the absence of constraints on shorting operations and low transaction costs. We document persistent evidence of both anomalies. Moreover, the excess returns present a similar pattern to those obtained in equity markets, even after adjusting for risk using asset pricing models, such as the CAPM, the Fama and French model, and the Carhart model. We present evidence that abnormal returns in futures markets are closely related to those obtained from similar strategies in stock markets, without being subordinate to the performance of the latter.

Keywords: financial futures, momentum and contrarian strategies.
JEL Classification: G13, G14.

Introduction

The efficient market hypothesis (EMH) has long been the cornerstone of academic studies focused on financial markets and asset pricing. However, in the last two decades, several studies have documented significant discrepancies between the real functioning of financial markets and the EMH (De Bondt and Thaler, 1985; Chan et al., 1996; Fama and French, 1996; Daniel et al., 1998; Avramov and Chordia, 2006; Tzogkidis and Zachouris, 2009; Fu and Kang, 2009). De Bondt and Thaler (DBT, 1985) obtained positive excess returns by buying shares that had performed poorly in previous years and selling those stocks with the best performance during the same period. According to DBT, the market overreacts to information; bad news has a deep impact on stock prices, lowering the price below a fair value (the contrary effect is seen in the case of good news). Consequently, in the medium or long term a *reversal* phenomenon is observed, as the overreaction disappears, and past losers outperform past winners.

Jegadeesh and Titman (JT, 1993) used data from the NYSE and Amex to build an opposing trading strategy to that of DBT, called *momentum*. They purchased shares with the best performance over the previous 1 to 12 months and sold stocks that had performed the worst over the same period. The authors documented excess returns for a 3- to 12-month holding period. Some of these abnormal returns dissipated in the following two years.

Other studies have tested these anomalies outside the US (Campbell and Limmack, 1997; Rouwenhorst, 1998; Sciereck et al., 1999; Chan et al., 2000; Antoniou et al., 2005; Leivo and Patari, 2011; De Haan and Kakes, 2011, for several European countries; Chang et al., 1995; Chui et al., 2000; Bettman et al. (2009), Wu, 2004; and Wu, 2011, for various Asian and Australian financial markets). Seghal et al. (2012) try to examine whether there are any prior return patterns in stock returns for BRIC markets, and they report strong momentum patterns for the sample markets with the exception of China. Empirical results show that the phenomenon is systematically observed elsewhere, although with different intensities.

In this study, we directly examine the possibility that similar trading strategies can produce excess returns for investors in future markets. While there has been ample evidence that momentum and contrarian strategies are successful in equity markets, little attention has been granted to futures contracts. Among this scarce evidence, Pirrong (2005) uses a sample of monthly observations from 1982 to 2003, with closing prices of approximately 50 contracts denominated in US dollars (in the US and European markets), and approximately 25 other local currency-denominated contracts traded in other markets worldwide. The analysis shows that the momentum effect is present for each trading period, but endures for only one year after portfolio formation, similarly to the situation in the equity markets. The contrarian pattern, in contrast, occurs only after the first year. Having established that momentum (contrarian) strategies produce abnormal returns, the author verifies that the extra profits are significant after controlling for canonical asset pricing models. To this end, the excess returns are regressed on the CAPM, the Fama and French (1993) model, and the Carhart (1997) factors. The results indicate that the extra returns are not captured by CAPM. When the Fama and French model is adopted, a marked relationship is observed with the size factor, which contributes to the amount of variance explained. The Carhart model is the most suitable for capturing the overall variance in both the momentum and reversal excess returns because it entails an equity momentum factor.

Miffre and Rallis (2007), and Fuertes et al. (2010), investigate the commodities' futures market with comparable results to those of Pirrong (2005) but they observe a lower intensity of the reversal pattern. Szakmary et al. (2009) examine the performance of trend-following trading strategies in commodity futures markets using a monthly dataset spanning 48 years and 28 markets. All the strategies they implement yield abnormal returns in at least 22 of the 28 markets.

Drawing on this literature, this study attempts to extend the research to Eurozone futures markets. These markets are especially suited to the implementation of momentum and contrarian trading strategies, thanks to the absence of short-trading constraints and the low transaction costs. To the best of our knowledge, this is the first study to analyze the excess returns obtained from these strategies exclusively across European futures markets.

The rest of the paper is organized as follows. Section 1 describes the dataset and the trading strategy. Section 2 documents the empirical results. We perform several robustness checks in section 3. Conclusions and final remarks are in the final section.

1. Dataset and methodology

1.1. Dataset. The sample comprises the most traded financial futures contracts in several important European markets. Thus, we depart from previous papers that concentrated on commodity contracts (Miffre and Rallis, 2007) or other underlying securities such as stock indexes, interest rates, crude oil, or other raw materials (Pirrong, 2005). All contracts are denominated in Euros. In order to avoid methodological errors that could affect the goodness-of-fit of the results, we excluded those contracts that had insufficient monthly exchanges.

For each futures contract we report monthly observations of closing prices from January 1999 to August 2010. We include in the sample only futures on the most important continental European stock indexes, government short-term and long-term bonds and interest rates[1]. As different futures have different entry dates in the dataset, the number of observations is not the same for each underlying security. This implies that the winner and loser portfolios for each month include a different number of contracts, ranging between 12 in January 2000 and 24 in the period from November 2007 to August 2010.

In Table 1, a brief summary of the characteristics of the futures contracts included in the sample is reported. The table includes the market in which the securities are listed, the month of entry into the dataset and the total number of monthly observations for each contract. For the purposes of our analysis, we use as a proxy for the market index, Stoxx Europe 600, and as a proxy for the risk-free rate, the one-month LIBOR[2] rate.

Table 1. Futures contracts comprising the dataset

Futures contract	Market	Month of entry into the dataset	Number of monthly observations
2-year Euro Swapnote	NYSE Euronext	April 2001	113
5-year Euro Swapnote	NYSE Euronext	May 2001	112
10-year Euro Swapnote	NYSE Euronext	June 2001	111
3-month Euribor	NYSE Euronext	January 1999	140
AEX	NYSE Euronext	January 1999	140
ATX	Austrian Stock Exchange	January 1999	140
Bel 20	NYSE Euronext	January 1999	140
CAC 40	NYSE Euronext	January 1999	140
DAX	Eurex	January 1999	140
DJ Euro Stoxx 50	Eurex	January 1999	140
DJ Euro Stoxx 50 (bank)	Eurex	June 2002	99
DJ Euro Stoxx 50 (insurance)	Eurex	October 2002	95
EURO Bobl	Eurex	January 1999	140
EURO Bund	Eurex	January 1999	140
EURO Buxl	Eurex	October 2005	59
EURO Schatz	Eurex	January 1999	140
FTSE Ase 20	Greece Stock Exchange	September 1999	132
FTSE Eurofirst 80	NYSE Euronext	December 2006	45
FTSE Mib	Italian Stock Exchange	February1999	139

[1] The 24 contracts comprising the sample are as follows: Euro Swapnote, two, five and 10 years, three-month Euribor, AEX, ATX, Bel 20, CAC 40, DAX, DJ Euro Stoxx 50, DJ Euro Stoxx 50 (insurance), DJ Euro Stoxx 50 (banking), Euro Bobl, Euro Bund, Euro Buxl, Euro Schatz, FTSE Ase 20, FTSE Eurofirst 80, FTSE Mib, Ibex 35, MDax, MSCI Pan-Euro, StoxxEurope 50, TecDAX.

[2] The LIBOR quotation is expressed in Euros.

Table 1 (cont.). Futures contracts comprising the dataset

Futures contract	Market	Month of entry into the dataset	Number of monthly observations
Ibex 35	Spanish Stock Exchange	January 1999	140
MDax	Eurex	April 2005	65
MSCI Pan-Euro	NYSE Euronext	June 1999	135
STOXX Europe 50	Eurex	January 1999	140
TecDAX	Eurex	April 2003	89

1.2. Methodology. The methodology used to determine the momentum and contrarian strategies draws on the original implementation by JT. First, we determined the monthly returns of the contracts, by calculating the first difference of logarithms and excluding the expiry month. In other words, when the futures contract is close to expiry, we use as a basis for the return the contract expiring in the next month or quarter[1]. We determined the mean returns of each contract at the beginning of the ranking period J^2 (with $J = 1, 3, 6, 9$, or 12 months). This operation was repeated every month until August 2010.

Once the returns had been calculated, we sorted (on a monthly basis) the contracts into ascending order based on the returns achieved in the previous ranking period. Thus, the assets with the worst average returns were ranked at the top, and the winners were placed at the bottom of the list. We defined loser portfolios as those that were ranked within the first five positions, and winners as those that were among the bottom five. Previous papers have usually opted for deciles or quintiles when choosing winners and losers (Lakonishok et al., 1994; Moskowitz and Grimblatt, 1999). That approach was not feasible here due to the small number of contracts in the sample. The winner and loser portfolios' returns were then determined by calculating the mean[3] returns across the five contracts in each group. This process was repeated each month in order to obtain two different time series.

Next, in every month t (from January 2000), we implemented our trading strategy by buying and holding the winner portfolios for K months and selling the losers[4] (K = 1, 3, 6, 9, 12, 60). The momentum portfolio was thus the difference between the two. The use of buy-and-hold techniques also allowed us to avoid costly monthly rebalancing, which could nullify any extra returns earned by these strategies. Finally, we defined the mean monthly return of a particular strategy "JK" as the average of the returns obtained from all momentum portfolios with a ranking period J and a retention period K^5. Overall, 30 strategies were implemented, obtained from a combination of 5 ranking periods J (1, 3, 6, 9, or 12 months), and 6 holding periods K (1, 3, 6, 9, 12, or 60 months). In this way, we were able to check for excess returns from the momentum strategies, which should occur within the first twelve months of ranking (and detention), and from the contrarian ones, which should be observed in the medium to long term (up to 60 months).

2. Empirical analysis

2.1. The profitability of the strategies implemented. In Table 2 (see the Appendix), the mean and median monthly returns of the winners, losers and momentum strategy are shown. We also present the monthly standard deviation, and t-tests that are adjusted for Newey-West (1987) standard errors. It can be observed that the winners obtain momentum portfolios that are superior to those of the losers. This trend, however, tends to be reversed for investments with a 60-month holding period. This is in line with the existing literature, which shows that the positive returns from winners tend to mean-revert in the long term. The same occurs for loser portfolios. In absolute values, the monthly average excess returns of the momentum portfolios increase to 1.53% for the strategy $J6/K1$. The performance improves until the sixth-month ranking period and then starts to decline. On the other hand, it can be noticed that the returns decrease as the holding period increases, so as to reach contrarian profits in a time span of 60 months. JT obtain similar values to ours for the $J6/K6$ and $J9/K3$ portfolios (0.97% and 1.14%, respectively), while Miffre and Rallis (2007) report a 0.72% excess return for the $J6/K6$ strategy.

With regard to the riskiness of the portfolios in terms of standard deviation, we note that winners are more stable compared to losers. Moreover, the

[1] Suppose we have a 3-month futures contract maturing in December. This contract will be used to determine the returns for September, October and November. The returns for December (along with January and February) will be computed from the contract expiring in March.

[2] The returns calculated in the ranking period include those obtained from portfolios built in the previous J months.

[3] We apply the same weight to each contract included in the portfolio. However, in some papers, the authors attribute more weight to contracts that performed better in the previous period (Jegadeesh and Titman, 1993; Miffre and Rallis, 2007).

[4] K identifies the holding period of the portfolio.

[5] In this study, we do not consider the costs incurred by the investor in the implementation of a strategy, such as transaction costs and any margin requirements.

volatility decreases as the holding period increases. The standard deviations of the momentums are generally higher than those of the respective winner and loser portfolios. These results are comparable to the findings reported in Miffre and Rallis (2007) for commodity futures markets.

In Table 2, the Shapiro-Wilk test results are also presented, indicating the likelihood that the portfolios' returns follow a normal distribution. It can be observed that this occurs with a significance level of 5% in 11 out of 90 cases (about 12%). For this reason, in Table 3 (see the Appendix) we include the values of a non-parametric test, the Wilcoxon test, to determine whether the median is significantly different from zero for winners and losers. For the momentum portfolios, we test the difference between the median values of the winners and losers.

Out of the 25 momentum portfolios, 24 show statistical significance at a level of at least 10% (only the portfolio $J1/K1$ seems not to be significant). If we focus on the contrarian strategies, only three of the five portfolios are found to be higly significant. We can, therefore, deduce that the implementation of the aforementioned strategies makes it possible to generate statistically significant excess profits even in the Euro futures markets. In the short term (i.e. less than or equal to twelve months), the winners have the most significant values, achieving mean returns ranging from 0.70% for strategy $J6/K1$ to 0.00% for $J3/K9$. In contrast, for a five-year holding period the loser portfolios' returns are more significant, with mean returns ranging from 0.40% (strategy $J12/K60$) to 0.23% (strategy $J6/K60$). From a joint analysis of Tables 2 and 3 it seems that the momentum effect is driven by winners, whereas the contrarian effect is most influenced by losers.

In Figure 1, we present the trend in the cumulated mean returns for winners, losers and momentum portfolios with a six-month ranking period. Winners and momentum present an inverted U-shaped performance, which produces a momentum curve that reaches its peak around 16 months after portfolio formation and then slowly decreases.

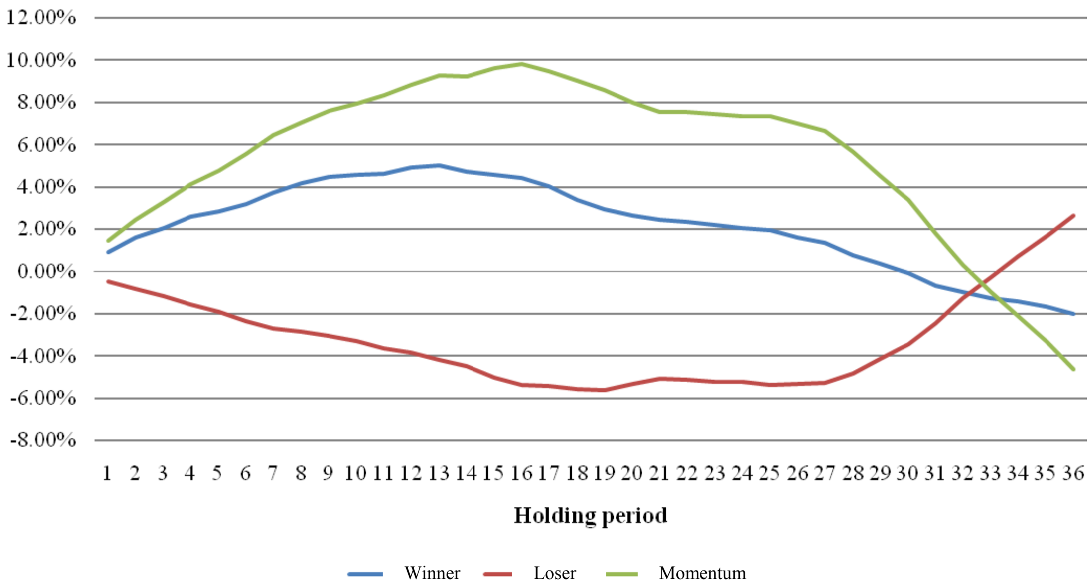

Fig. 1. Trends in accumulated mean returns for winner, loser and momentum portfolios with a 6-month ranking period

2.2. Controlling for common risk models. In this section, we control whether the abnormal returns are simply a reward for risk that can be captured by canonical risk models. We include in the analysis only those portfolios with significant excess returns at the 10% level (29 out of 30 in Table 3). First, we use the CAPM, then the Fama and French 3-factor model, and finally the Carhart model.

The CAPM specification is as follows:

$$R_{MOMt} = \alpha + \beta_{MKT}(r_{MKTt} - r_{ft}) + \varepsilon_t, \quad (1)$$

where R_{MOMt} is the excess return from the momentum portfolio, α is the alpha of Jensen, $r_{MKT} - r_{ft}$ is the market return in excess of the risk-free rate (1-month LIBOR), and ε_t is the error term.

The Fama and French model is as follows:

$$R_{MOMt} = \alpha + \beta_{MKT}(r_{MKTt} - r_{ft}) + \\ + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \varepsilon_t, \quad (2)$$

where SMB represents the difference between the returns of a portfolio of small capitalization companies and those of a portfolio of large-cap companies, and HML represents the difference between the return of a portfolio long in high book-to-market (BM) stocks and short in low-BM stocks.

Finally, the last set of regressions considers the classical model of Fama and French, enhanced by the Carhart factor. Thus, in addition to the factors already outlined above, a stock momentum factor (MOM_t) is added, which is referred to as the US stock market[1]:

$$R_{MOMt} = \alpha + \beta_{MKT}(r_{MKTt} - r_{ft}) + \beta_{SMB} SMB_t + \beta_{HML} HML_t + \beta_{MOM} MOM_t + \varepsilon_t. \quad (3)$$

We test all regressions for the presence of autocorrelation and heteroskedasticity (the Breusch-Godfrey and White tests, respectively)[2]. Both tests are significant at the 10% level, so we apply robust Newey-West errors to the OLS regressions.

The results are reported in Tables 4a and 4b (see the Appendix), which in addition to the coefficients also report their *t*-test corrected for autocorrelation and heteroskedasticity. Various findings stand out. If we consider the intercepts, 34 out of 81 (about 40%) are not statistically significant (especially when the market loading has significantly elevated values). This effect seems, therefore, to be attributable to the market index. In contrast, the alphas are strongly significant when the models of Fama and French, or that of Carhart, are adopted.

With regard to the risk factors analyzed it can be concluded that the market is an important factor in more than half of the estimates made, by focusing his greatest influence strategies that have retention periods that vary between 1 and 9 months. When the focus is shifted onto the factors of Fama and French, results show that while the factor that considers the risk associated with size (SMB) is not influential in explaining the abnormal returns (this shows significance only in 7 estimates), the variable that captures the risk related to the relationship between book value and market value (HML) proves influential, reaching above the significance values in about half of the estimates. Both factors present themselves as very important in explaining contrarian excess returns, as demonstrated by the authors in their 1996 work. The last, but the most important, variable is "momentum stocks", where 18 out of 27 estimates assume coefficients statistically significant (and never below 5%). The impact on the explanation of the momentum returns can also be inferred from observation of the values of the adjusted *R*-squares; estimates of the CAPM and 3-factor model of Fama and French take on an average coefficient of, respectively, 13.93% and 18.07%, and when Carhart's variable is inserted, the adjusted *R*-squares stand at 25.89% (further demonstration of the importance of the factor for the explanation of momentum). After such evidence, it can be stated that none of the three models used provides a full explanation of the phenomenon, so much so that many of the extra-returns continue to prove significantly different from zero. Also, these estimates may be affected by the financial crisis of 2008.

3. Robustness checks

3.1. Exclusion of sub-prime crisis observations. In this section we investigate whether the sub-prime crisis that began in 2008 might have affected the excess returns of different portfolios and their standard deviations. Consequently, we drop from the initial sample all observations dating from January 2007 onward. The new sample comprises 96 monthly observations. The results are presented in Table 5 (see the Appendix).

We can deduce that abnormal returns are still significant in 25 out of 30 portfolios. They do not differ markedly from those detected in the total sample, shown in Table 2. This is due to the winners, as the losers for some reason performed worse than they did in the total sample. Nevertheless, if the period of collapse of the markets is not included, excess returns are lower but less risky than when that period is included. For example, consider the *J*6/*K*1 as a benchmark. It was the best performer when all observations were included, with a mean excess return of 1.53% associated with a monthly standard deviation of 6.71%. This strategy involved buying a winner portfolio with a return of 0.70% (standard deviation = 3.28%) and selling a loser portfolio that yielded -0.83% (standard deviation = 6.33%). Excluding the crisis period, the same strategy generated a 1.41% excess return with a standard deviation of 5.44%. If we calculate the Sharpe index for both momentum portfolios, it can be seen that the second is better (0.259 versus 0.228), notwithstanding its lower excess return.

These findings can be extended to all of the strategies analyzed. The returns of the winners and losers are higher and less risky than for the overall sample. The results permit us to state that the crisis has had a negative impact on the performance of the strategies, increasing their risk proportionally more than their returns.

3.2. OLS regressions excluding sub-prime crisis observations. Since the financial crisis may have strongly influenced the excess returns obtained from the full sample, further examination is required even of the regression analysis we performed in section 2.2, excluding from the sample those observations related to the period of the sub-prime crisis.

[1] All the time series of these factors were downloaded from the website of Professor K. French (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html).

[2] The test results are available on request.

Tables 6a and 6b (see the Appendix) show the estimated coefficients and their *t*-tests, corrected for autocorrelation and heteroskedasticity. Although it is not possible to examine the contrarian portfolios due to an insufficient number of delayed observations present in the sample, we can immediately observe the stronger statistical significance of these strategies, as no alpha, out of the 72 tested, is statistically equal to zero. The regressions performed using the CAPM are unable to explain the abnormal returns obtained using the momentum portfolios. In fact, the beta coefficient associated with the excess market return seems to be significant only for strategies with a holding period greater than, or equal to, nine months, reducing its impact in relation to the analysis in section 2.2. The same evidence can be inferred from observation of the average value taken from the *R*-square, which stood at 5.29% (a decrease of almost 9 percentage points than before).

Even the estimates produced by equation (2) reveal that the factors SMB and HML are not of crucial importance in explaining the phenomenon in the short term, considering that the first is significant on only two occasions, while the second assumes importance in about one third of the regressions, but fails to eliminate the significance of the momentum strategy's excess return. Considering this second model we can assert that notwithstanding the fact that the average value of adjusted *R*-square is higher than in CAPM (12.61%), the factors used are far from providing a full explanation of the phenomenon. The Carhart model proves to be the most reliable, as the stock momentum factor is strongly significant in 15 out of 24 regressions performed, increasing the average value of the adjusted *R*-square to 21.01%.

After this results the alpha regressions still appear significant, despite the importance shown by stock momentum factor; this results proves the connection between the abnormal returns obtained in futures markets and those obtained in stocks markets, but at the same time demonstrates that momentum in futures markets doesn't depend by anomaly in stock markets.

After performing the analysis on both samples we can safely say that the sub-prime crisis has impacted heavily on the implementation of strategies, in particular, increasing the risk. Note that in the first half of 2009, the strategy (applied to equities) recorded an average monthly yield equal to -17%; in particular, one can point out the monthly returns between January and June that achieved -17.02%, 3.40%, -23.49%, -40.62%, -23.23%, and -1.85%, respectively.

Conclusions

The objective of this study was to empirically verify the existence and profitability of momentum and contrarian strategies in European futures markets, by investigating financial futures exclusively traded in Euros. The reason for this decision lay in the fact that nearly all of the extant research has focused almost exclusively on stocks listed in the US.

Our analysis produced several results. First, we can affirm that momentum and contrarian strategies in futures markets can be profitable, just as those implemented in stock markets are. Momentum excess returns rise in the short term, while contrarian ones do so as the time span increases. We notice also that winners perform better in the short term, and then tend to mean-revert, in contrast to losers, which are profitable in the long term. This is in line with previous literature (Jegadeesh and Titman, 1993; Pirrong, 2005).

The sub-prime crisis of 2008 has markedly affected the riskiness of all portfolios, by increasing their standard deviation. After calculating Sharpe ratios, we evidenced that the portfolios performed better in the pre-crisis period, and thus they should have been preferred by investors although they yielded lower returns then.

Second, we checked whether the traditional asset pricing models were able to explain the abnormal returns realized by the strategies. The market factor proved to be highly significant for the total sample, but had less power when we dropped the post-2008 observations. The momentum factor of the Carhart model was the most significant for all holding periods, even for the reduced sample, while the three factors of Fama and French were better able to explain the contrarian excess returns.

In summary, we conclude that momentum and contrarian anomalies are not restricted to the stock market. Furthermore, none of the traditional models of asset pricing appears to thoroughly eliminate the significance of these excess returns, thereby confirming the fact that, to date, there is no unambiguous explanation of the phenomenon.

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Appendix

Table 2. Summary statistics of the winner, loser and momentum portfolio returns

	Holding period:1 month			Holding period: 3 months			Holding period: 6 months			Holding period: 9 months			Holding period: 12 months			Holding period: 60 months		
	Win	Los	Mom	Win	Los	Mom	Win	Los	Mom	Win	Los	Mom	Win	Los	Mom	Win	Los	Mom
Panel A. Ranking period: 1 month																		
Mean	-0.02 (0.96)	-0.63 (0.20)	0.61 (0.24)	0.08 (0.81)	-0.56 (0.23)	0.64 (0.10)	0.03 (0.93)	-0.46 (0.29)	0.49 (0.03)	-0.05 (0.91)	-0.44 (0.32)	0.39 (0.03)	-0.04 (0.93)	-0,44 (0,33)	0,41 (0,00)	0,18 (0,02)	0,18 (0,02)	-0.01 (0.86)
SD	4.73	5.50	5.79	2.89	3.69	3.81	2.53	2.69	2.90	2.14	2.21	2.39	1.87	1,98	2,08	0,47	0,45	0.59
SW	0.89 (0.00)	0.90 (0.00)	0.95 (0.00)	0.86 (0.00)	0.83 (0.00)	0.94 (0.00)	0.80 (0.00)	0.89 (0.00)	0.93 (0.00)	0.88 (0.00)	0.94 (0.00)	0.97 (0.00)	0.90 (0.00)	0,96 (0,00)	0,99 (0,27)	0,99 (0,73)	0,95 (0,01)	0.99 (0.83)
Panel B. Ranking period: 3 months																		
Mean	0.38 (0.26)	-0.65 (0.24)	1.02 (0.09)	0.22 (0.52)	-0.60 (0.22)	0.82 (0.09)	0.03 (0.93)	-0.44 (0.32)	0.47 (0.18)	0.00 (1.00)	0.35 (0.43)	0.35 (0.16)	-0.02 (0.96)	-0.37 (0.43)	0.35 (0.16)	0.14 (0.09)	0.24 (0.00)	-0.09 (0.05)
SD	3.75	6.24	6.73	2.67	3.72	4.04	2.41	2.77	3.21	2.08	2.31	2.62	1.81	2.08	2.06	0.49	0.48	0.63
SW	0.97 (0.02)	0.84 (0.00)	0.92 (0.00)	0.95 (0.00)	0.85 (0.00)	0.88 (0.00)	0.83 (0.00)	0.90 (0.00)	0.87 (0.00)	0.87 (0.00)	0.95 (0.00)	0.92 (0.00)	0.91 (0.00)	0.94 (0.00)	0.96 (0.00)	0.98 (0.41)	0.97 (0.05)	0.97 (0.16)
Panel C. Ranking period: 6 months																		
Mean	0.70 (0.02)	-0.83 (0.14)	1.53 (0.01)	0.49 (0.08)	-0.72 (0.14)	1.21 (0.01)	0.35 (0.22)	-0.61 (0.24)	0.97 (0.05)	0.33 (0.30)	-0.58 (0.30)	0.91 (0.07)	0.24 (0.52)	-0.54 (0.31)	0.79 (0.07)	0.07 (0.41)	0.30 (0.00)	-0.23 (0.00)
SD	3.28	6.33	6.71	2.21	3.68	3.83	1.70	2.93	3.12	1.50	2.57	2.69	1.52	2.24	2.21	0.48	0.46	0.63
SW	0.98 (0.05)	0.86 (0.00)	0.93 (0.00)	0.95 (0.00)	0.90 (0.00)	0.94 (0.00)	0.91 (0.00)	0.90 (0.00)	0.91 (0.00)	0.96 (0.00)	0.93 (0.00)	0.97 (0.00)	0.94 (0.00)	0.93 (0.00)	0.98 (0.18)	0.98 (0.27)	0.91 (0.00)	0.97 (0.14)
Panel D. Ranking period: 9 months																		
Mean	0.57 (0.06)	-0.79 (0.16)	1.36 (0.02)	0.45 (0.10)	-0.69 (0.21)	1.14 (0.05)	0.41 (0.15)	-0.65 (0.26)	1.06 (0.07)	0.35 (0.29)	-0.64 (0.27)	0.99 (0.08)	0.28 (0.50)	-0.57 (0.27)	0.85 (0.06)	0.05 (0.61)	0.36 (0.00)	-0.31 (0.00)
SD	3.42	6.35	6.73	2.08	3.96	4.21	1.54	3.11	3.33	1.47	2.61	2.78	1.62	2.16	2.23	0.50	0.42	0.62
SW	0.93 (0.00)	0.85 (0.00)	0.91 (0.00)	0.93 (0.00)	0.88 (0.00)	0.92 (0.00)	0.97 (0.00)	0.88 (0.00)	0.94 (0.00)	0.96 (0.00)	0.92 (0.00)	0.98 (0.06)	0.88 (0.00)	0.92 (0.00)	0.97 (0.00)	0.96 (0.02)	0.90 (0.00)	0.98 (0.19)
Panel E. Ranking period: 12 months																		
Mean	0.47 (0.12)	-0.63 (0.25)	1.10 (0.07)	0.44 (0.12)	-0.60 (0.25)	1.05 (0.08)	0.41 (0.16)	-0.59 (0.30)	1.00 (0.11)	0.37 (0.27)	-0.60 (0.28)	0.97 (0.08)	0.24 (0.57)	-0.48 (0.31)	0.73 (0.13)	0.00 (0.96)	0.40 (0.00)	-0.40 (0.00)
SD	3.38	6.15	6.78	2.12	3.83	4.37	1.56	3.08	3.44	1.43	2.56	2.82	1.69	2.02	2.38	0.50	0.39	0.59
SW	0.92 (0.00)	0.86 (0.00)	0.93 (0.00)	0.93 (0.00)	0.86 (0.00)	0.95 (0.00)	0.97 (0.00)	0.87 (0.00)	0.95 (0.00)	0.96 (0.00)	0.91 (0.00)	0.97 (0.00)	0.89 (0.00)	0.91 (0.00)	0.98 (0.07)	0.94 (0.00)	0.90 (0.00)	0.96 (0.04)

Notes: Means and standard deviations (SD) are on a monthly basis and in percentiles. The *p*-values of *t*-test are reported in brackets for Newey-West errors. The last two rows contain, respectively, the Shapiro-Wilk test (SW) and associate *p*-value.

Table 3. Summary statistics of winner, loser and momentum portfolio returns

	Holding period: 1 month			Holding period: 3 months			Holding period: 6 months			Holding period: 9 months			Holding period: 12 months			Holding period: 60 months		
	Win	Los	Mom	Win	Los	Mom	Win	Los	Mom	Win	Los	Mom	Win	Los	Mom	Win	Los	Mom
Panel A. Ranking period: 1 month																		
Median	0.61	-0.05	0.66	0.28	-0.10	0.38	0.27	-0.16	0.43	0.25	0.01	0.25	0.35	-0.05	0.40	0.12	0.09	0.03
Z-test	0.97	-0.60	1.00	1.60	-1.15	1.86	2.04	-1.45	2.48	1.47	-1.24	2.04	1.52	-1.53	2.21	2.84	3.46	-0.05
	[0.33]	[0.55]	[0.31]	[0.11]	[0.25]	[0.06]	[0.04]	[0.15]	[0.01]	[0.14]	[0.22]	[0.04]	[0.13]	[0.13]	[0.03]	[0.00]	[0.00]	[0.96]
Panel B. Ranking period: 3 months																		
Median	0.29	-0.04	0.33	0.37	-0.15	0.52	0.39	-0.13	0.53	0.37	0.02	0.36	0.28	-0.02	0.30	0.12	0.15	-0.04
Z-test	1.36	-0.37	1.97	1.98	-1.15	2.21	1.85	-1.51	2.79	1.65	-0.94	2.54	1.21	-0.91	2.12	2.34	3.79	-1.18
	[0.17]	[0.71]	[0.05]	[0.05]	[0.25]	[0.03]	[0.06]	[0.13]	[0.01]	[0.10]	[0.35]	[0.01]	[0.23]	[0.36]	[0.03]	[0.02]	[0.00]	[0.24]
Panel C. Ranking period: 6 months																		
Median	0.13	0.04	0.09	0.44	-0.16	0.60	0.44	-0.19	0.63	0.49	-0.04	0.54	0.32	-0.07	0.39	0.10	0.14	-0.04
Z-test	2.07	-0.81	2.95	3.12	-1.66	4.10	2.99	-2.09	4.31	3.14	-1.32	3.82	2.79	-1.42	3.79	1.41	5.00	-2.70
	[0.04]	[0.42]	[0.00]	[0.00]	[0.10]	[0.00]	[0.00]	[0.04]	[0.00]	[0.00]	[0.19]	[0.00]	[0.01]	[0.16]	[0.00]	[0.16]	[0.00]	[0.01]
Panel D. Ranking period: 9 months																		
Median	0.26	-0.19	0.45	0.40	-0.10	0.50	0.30	-0.07	0.37	0.35	-0.05	0.40	0.34	-0.07	0.41	0.09	0.18	-0.09
Z-test	2.33	-1.24	3.08	3.02	-1.38	3.46	3.23	-1.39	3.62	3.47	-1.20	3.67	3.55	-1.50	3.61	1.00	6.08	-3.58
	[0.02]	[0.21]	[0.00]	[0.00]	[0.17]	[0.00]	[0.00]	[0.17]	[0.00]	[0.00]	[0.23]	[0.00]	[0.00]	[0.13]	[0.00]	[0.32]	[0.00]	[0.00]
Panel E. Ranking period: 12 months																		
Median	0.39	0.01	0.38	0.40	-0.02	0.42	0.31	0.04	0.28	0.47	-0.09	0.56	0.36	-0.06	0.42	0.07	0.24	-0.17
Z-test	2.13	-0.81	2.05	3.02	-0.76	2.75	3.37	-1.14	3.12	3.81	-1.31	3.32	3.43	-1.20	2.91	0.43	6.84	-4.49
	[0.03]	[0.42]	[0.04]	[0.00]	[0.45]	[0.01]	[0.00]	[0.25]	[0.00]	[0.00]	[0.19]	[0.00]	[0.00]	[0.23]	[0.00]	[0.67]	[0.00]	[0.00]

Notes: Means, medians and standard deviations (SD) are on a monthly basis and in percentiles. The last two rows show the values of the Shapiro-Wilk test and relative *p*-value for normal distribution.

Table 4a. OLS estimates for the observations with 3-6-month ranking period in 2000-2010

Panel A. Ranking period: 3 months																		
	Holding period: 1 month			Holding period: 3 months			Holding period: 6 months			Holding period: 9 months			Holding period: 12 months			Holding period: 60 months		
	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4
α	0.0068 (1,27)	0.0059 (1.09)	0.0068 (1.28)	0.0057 (1.37)	0.0090 (2.19)	0.0096 (2,44)	0.0043 (1.29)	0.0108 (2.63)	0.0103 (2.32)	0.0029 (1.02)	0.0036 (1.21)	0.0041 (1.47)	0.0026 (0.90)	0.0040 (1.07)	0.0044 (1.14)			
β_{MKT}	-0.6165 (-3.17)	-0.6527 (-3.33)	-0.4915 (-2.59)	-0.4536 (-1.77)	-0.4209 (-1.76)	-0.2768 (-1.11)	-0.0785 (-1.02)	-0.0277 (-0.43)	-0.0164 (-0.25)	-0.1075 (-0.63)	-0.1023 (-0.62)	-0.0078 (-0.06)	-0.1503 (-1.05)	-0.1427 (-1.04)	-0.0162 (-0.14)			
β_{SMB}	-	0.1966 (1.02)	0.1059 (0.63)	-	-0.0814 (-0.46)	-0.1143 (-0.66)	-	-0.4740 (-1.50)	-0.3500 (-1.23)	-	-0.1127 (-0.42)	-0.0319 (-0.12)	-	-0.0155 (-0.04)	0.1931 (0.56)			
β_{HML}	-	-0.0431 (-0.24)	-0.0215 (-0.13)	-	-0.3812 (-2.33)	-0.3562 (-2.00)	-	-0.5599 (-1.84)	-0.5745 (-1.71)	-	-0.0303 (-0.17)	-0.0706 (-0.39)	-	-0.1929 (-1.30)	-0.2633 (-1.51)			
β_{MOM}	-	-	0.2653 (2.55)	-	-	0.2777 (2.42)	-	-	0.2707 (1.53)	-	-	0.2269 (1.33)	-	-	0.3344 (3.47)			
Adj. R^2	0.2006	0.2034	0.2531	0.1305	0.1588	0.2066	0.0069	0.0980	0.1441	0.0011	-0.0145	0.0096	0.0160	0.0122	0.0885			
Panel B. Ranking period: 6 months																		
	Holding period: 1 month			Holding period: 3 months			Holding period: 6 months			Holding period: 9 months			Holding period: 12 months			Holding period: 60 months		
	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4
α	0.0112 (2.16)	0.0102 (1.95)	0.0113 (2.29)	0.0089 (2.18)	0.0095 (2.36)	0.0102 (2.72)	0.0089 (1.99)	0.0121 (2.47)	0.0111 (2.12)	0.0057 (1.37)	0.0064 (1.18)	0.0070 (1.26)	0.0053 (1.25)	0.0061 (1.04)	0.0063 (1.06)	-0.0024 (-2.99)	-0.0023 (-1.93)	-0.0023 (-1.73)
β_{MKT}	-0.7404 (-4.56)	-0.7821 (-4.90)	-0.5735 (-3.84)	-0.5714 (-2.80)	-0.5785 (-2.90)	-0.4195 (-2.12)	-0.1469 (-2.09)	-0.1186 (-2.26)	-0.0989 (-1.97)	-0.5719 (-2.37)	-0.5615 (-2.53)	-0.4320 (-1.80)	-0.4160 (-1.94)	-0.4054 (-1.99)	-0.3141 (-1.43)	-0.0623 (-0.32)	-0.1473 (-0.85)	-0.1278 (-0.72)
β_{SMB}	-	0.2270 (1.18)	0.1098 (0.69)	-	0.1066 (0.78)	0.0704 (0.47)	-	-0.1356 (-0.35)	0.0814 (0.26)	-	0.2682 (0.65)	0.3788 (0.91)	-	0.2639 (0.49)	0.4144 (0.80)	-	0.8895 (1.94)	1.0521 (3.25)
β_{HML}	-	-0.0471 (-0.26)	-0.0191 (-0.11)	-	-0.1448 (-1.07)	-0.1173 (-0.72)	-	-0.3372 (-1.40)	-0.3627 (-1.26)	-	-0.2529 (-1.23)	-0.3081 (-1.34)	-	-0.2695 (-0.99)	-0.3203 (-1.15)	-	-0,6705 (-1.99)	-1.0060 (-3.29)
β_{MOM}	-	-	0.3433 (3.62)	-	-	0.3063 (2.40)	-	-	0.4740 (3.20)	-	-	0.3109 (2.29)	-	-	0.2412 (1.55)	-	-	0.6413 (2.67)
Adj. R^2	0.2947	0.3041	0.3931	0.2362	0.2344	0.3022	0.0481	0.0653	0.2321	0.2481	0.2607	0.3126	0.1557	0.1701	0.2012	-0.0123	0.0390	0.1442

Table 4b. OLS estimates for the observations with 9- 12-month ranking period in the years 2000-2010

Panel C. Ranking period: 9 months																		
	Holding period: 1 month			Holding period: 3 months			Holding period: 6 months			Holding period: 9 months			Holding period: 12 months			Holding period: 60 months		
	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4
α	0.0094 (1.86)	0.0090 (1.71)	0.0104 (2.14)	0.0068 (1.58)	0.0085 (1.92)	0.0094 (2.28)	0.0095 (1.78)	0.0146 (2.37)	0.0133 (2.00)	0.0059 (1.22)	0.0092 (1.36)	0.0098 (1.38)	0.0061 (1.38)	0.0096 (1.49)	0.0098 (1.46)	-0.0030 (-3.73)	-0.0020 (-1.68)	-0.0021 (-1.52)
β_{MKT}	-0.7486 (-4.34)	-0.7944 (-4.73)	-0.5424 (-3.37)	-0.8090 (-4.09)	-0.8039 (-4.34)	-0.5986 (-3.06)	-0.2039 (-2.47)	-0.1597 (-2.77)	-0.1336 (-2.44)	-0.6692 (-2.89)	-0.6386 (-3.18)	-0.5091 (-2.44)	-0.3903 (-1.68)	-0.3692 (-1.68)	-0.2837 (-1.39)	0.0539 (0.29)	-0.0994 (-0.59)	-0.0795 (-0.45)
β_{SMB}	-	0.2284 (1.29)	0.0868 (0.62)	-	0.0672 (0.50)	0.0204 (0.13)	-	-0.2006 (-0.47)	0.0871 (0.23)	-	0.0760 (0.16)	0.1866 (0.39)	-	0.0990 (0.16)	0.2400 (0.40)	-	1.0668 (2.43)	1.2329 (3.69)
β_{HML}	-	-0.1285 (-0.77)	-0.0947 (-0.63)	-	-0.2630 (-2.45)	-0.2274 (-1.83)	-	-0.5282 (-2.18)	-0.5619 (-1.94)	-	-0.4666 (-1.81)	-0.5219 (-1.90)	-	-0.5342 (-2.01)	-0.5817 (-2.09)	-	-0.9781 (-3.51)	-1.3209 (-4.92)
β_{MOM}	-	-	0.4147 (4.96)	-	-	0.3956 (4.72)	-	-	0.6285 (6.10)	-	-	0.3108 (2.13)	-	-	0.2259 (1.22)	-	-	0.6552 (2.61)
Adj. R^2	0.2993	0.3179	0.4496	0.3984	0.4098	0.5075	0.0867	0.1422	0.4041	0.3202	0.3651	0.4142	0.1335	0.2072	0.2333	-0.0129	0.1218	0.2359
Panel D. Ranking period 12 months																		
	Holding period: 1 month			Holding period: 3 months			Holding period: 6 months			Holding period: 9 months			Holding period: 12 months			Holding period: 60 months		
	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4
α	0.0069 (1.36)	0.0081 (1.52)	0.0095 (1.97)	0.0062 (1.34)	0.0097 (2.07)	0.0107 (2.45)	0.0089 (1.60)	0.0159 (2.47)	0.0146 (2.12)	0.0059 (1.22)	0.0119 (1.71)	0.0125 (1.69)	0.0056 (1.24)	0.0112 (1.73)	0.0114 (1.69)	-0.0038 (-5.00)	-0.0016 (-1.45)	-0.0017 (-1.48)
β_{MKT}	-0.7276 (-4.11)	-0.7653 (-4.52)	-0.5065 (-2.97)	-0.7605 (-3.55)	-0.7358 (-3.68)	-0.5107 (-2.40)	-0.2121 (-2.44)	-0.1519 (-2.62)	-0.1263 (-2.27)	-0.6399 (-2.56)	0.5882 (-2.89)	-0.4593 (-2.27)	-0.2777 (-1.03)	-0.2487 (-0.99)	-0.1682 (-0.74)	0.1083 (0.66)	-0.0831 (-0.57)	-0.0674 (-0.51)
β_{SMB}	-	0.1360 (0.80)	-0.0095 (-0.07)	-	0.0060 (0,04)	-0.0454 (-0.25)	-	-0.3249 (-0.73)	-0.0432 (-0.11)	-	-0.1494 (-0.30)	-0.0394 (-0.08)	-	-0.0603 (-0.09)	0.0725 (0.12)	-	0.7475 (1.64)	0.8783 (2.43)
β_{HML}	-	-0.2970 (-1.84)	-0.2623 (-1.63)	-	-0,4599 (-3,53)	-0.4209 (-3.35)	-	-0.7101 (-3.15)	-0.7431 (-2.79)	-	-0.6800 (-2.63)	-0.7350 (-2.62)	-	-0.7300 (-2.86)	-0.7748 (-2.80)	-	-0.9702 (-3.71)	-1.2402 (-4.62)
β_{MOM}	-	-	0.4260 (4.76)	-	-	0.4337 (5.32)	-	-	0.6154 (5.85)	-	-	0.3093 (2.08)	-	-	0.2128 (1.02)	-	-	0.5160 (2.70)
Adj. R^2	0.2780	0.3099	0.4469	0.3242	0.3676	0.4764	0.0879	0.1961	0.4308	0.2840	0.3884	0.4357	0.0546	0.1840	0.2025	-0.0061	0.1573	0.2316

Notes: The models tested are the CAPM, Fama and French 3-factor model, and the Carhart model. In the last row, the adjusted Theil R^2 is reported.

Table 5. Summary statistics of winner, loser and momentum portfolio returns for sample period January 2000-December 2007

	Holding period: 1 month			Holding period: 3 months			Holding period: 6 months			Holding period: 9 months			Holding period: 12 months			Holding period: 36 months		
	Win	Los	Mom	Win	Los	Mom	Win	Los	Mom	Win	Los	Mom	Win	Los	Mom	Win	Los	Mom
Panel A. Ranking period: 1 month																		
Mean	0.15	-0.19	0.34	0.34	-0.19	0.54	0.31	-0.16	0.48	0.32	-0.22	0.54	0.31	-0.20	0.51	0.34	0.03	0.31
Median	0.64 [1.16]	-0.02 [0.07]	0.66 [1.05]	0.34 [2.18]	-0.04 [-0.28]	0.38 [1.89]	0.34 [2.68]	-0.15 [-0.44]	0.49 [2.45]	0.53 [2.77]	0.05 [-0.53]	0.48 [2.73]	0.53 [1.85]	0.01 [-0.60]	0.52 [2.68]	0.41 [2.69]	0.13 [0.50]	0.28 [2.11]
SD	3.45	4.22	4.63	1.99	2.66	3.06	1.69	1.88	2.18	1.60	1.69	1.90	1.48	1.59	1.72	1.11	1.04	1.18
Panel B. Ranking period: 3 months																		
Mean	0.54	-0.23	0.77	0.39	-0.19	0.58	0.37	-0.22	0.58	0.40	-0.19	0.59	0.34	-0.15	0.50	0.36	0.12	0.23
Median	0.29 [1.56]	0.07 [0.62]	0.22 [1.45]	0.42 [2.49]	-0.10 [-0.17]	0.52 [2.08]	0.52 [2.69]	-0.01 [-0.68]	0.53 [2.94]	0.75 [3.02]	0.00 [-0.59]	0.75 [3.51]	0.76 [2.59]	-0.02 [-0.38]	0.78 [3.02]	0.31 [2.66]	0.10 [1.11]	0.21 [1.89]
SD	3.29	4.78	5.40	2.36	2.59	2.67	1.89	1.90	1.95	1.68	1.73	1.74	1.61	1.54	1.54	1.26	1.03	1.18
Panel C. Ranking period: 6 months																		
Mean	0.87	-0.54	1.41	0.69	-0.40	1.09	0.60	-0.36	0.97	0.63	-0.35	0.98	0.58	-0.31	0.89	0.37	0.12	0.25
Median	0.15 [2.39]	0.23 [-0.07]	-0.08 [2.70]	0.50 [3.96]	0.13 [-0.73]	0.62 [3.79]	0.56 [4.16]	0.09 [-1.17]	0.66 [4.73]	0.68 [4.45]	-0.04 [-0.82]	0.73 [4.77]	0.52 [4.03]	-0.07 [-0.71]	0.59 [4.48]	0.39 [2.97]	0.10 [1.05]	0.28 [1.60]
SD	3.16	4.80	5.44	2.04	2.59	2.93	1.70	1.91	2.25	1.45	1.80	1.89	1.40	1.65	1.76	1.27	1.01	1.32
Panel D. Ranking period: 9 months																		
Mean	0.88	-0.59	1.47	0.81	-0.51	1.32	0.77	-0.54	1.31	0.72	-0.49	1.21	0.68	-0.42	1.10	0.38	0.16	0.22
Median	0.46 [2.72]	-0.03 [-0.70]	0.48 [3.31]	0.46 [3.96]	-0.05 [-0.98]	0.51 [4.50]	0.51 [4.53]	-0.07 [-1.22]	0.58 [5.25]	0.55 [4.91]	-0.07 [-1.15]	0.62 [5.19]	0.52 [4.75]	-0.10 [-0.87]	0.62 [4.75]	0.44 [2.67]	0.02 [1.12]	0.42 [1.16]
SD	3.10	4.66	5.26	1.82	2.76	2.83	1.40	2.07	2.10	1.30	1.85	1.87	1.31	1.65	1.72	1.35	0.90	1.42
Panel E. Ranking period: 12 months																		
Mean	0.80	-0.52	1.32	0.80	-0.52	1.33	0.72	-0.49	1.21	0.65	-0.45	1.10	0.59	-0.37	0.96	0.29	0.21	0.08
Median	0.55 [2.63]	0.21 [-0.32]	0.34 [2.73]	0.47 [3.84]	-0.07 [-0.65]	0.54 [3.91]	0.44 [4.34]	0.00 [-1.24]	0.44 [4.54]	0.63 [4.62]	-0.09 [-1.10]	0.72 [4.41]	0.65 [4.36]	-0.09 [-0.79]	0.73 [3.90]	0.43 [1.99]	0.02 [0.78]	0.41 [0.26]
SD	3.17	4.55	5.38	1.91	2.68	3.07	1.46	2.01	2.24	1.36	1.79	1.97	1.44	1.55	1.85	1.40	1.53	1.46

Notes: Means, medians and standard deviations (SD) are on a monthly basis and in percentiles. Wilcoxon *Z*-tests are reported in brackets.

Table 6a. OLS estimates for the observations with 3-6-month ranking period in the sub-sample 2000-2007

Panel A. Ranking period: 3 months																		
	Holding period: 1 month			Holding period: 3 months			Holding period: 6 months			Holding period: 9 months			Holding period: 12 months			Holding period: 36 months		
	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4
α				0.0055 (1.72)	0.0079 (2.06)	0.0069 (1.86)	0.0057 (1.82)	0.0082 (2.25)	0.0083 (2.06)	0.0059 (2.79)	0.0088 (3.51)	0.0082 (3.02)	0.0052 (2.59)	0.0074 (2.39)	0.0065 (2.23)	0.0027 (1.83)	0.0097 (4.20)	0.0083 (3.70)
β_{MKT}				-0.1489 (-0.73)	-0.1789 (-0.91)	-0.0520 (-0.26)	-0.0689 (-1.27)	-0.0654 (-1.37)	-0.0656 (-1.32)	-0.0347 (-0.20)	-0.0688 (-0.37)	-0.0322 (-0.20)	0.0802 (0.59)	0.0380 (0.23)	0.1020 (0.75)	0.2425 (1.70)	0.0552 (0.32)	0.1257 (1,09)
β_{SMB}				-	-0.422 (-0.29)	-0.0930 (-0.61)	-	-0.1221 (-0.47)	-0.1243 (-0.47)	-	-0.1699 (-0.60)	-0.1478 (-0.57)	-	-0.0905 (-0.23)	-0.0395 (-0.11)	-	-0.0720 (-0.08)	0.0958 (0.14)
β_{HML}				-	0,2549 (-1.81)	-0.2219 (-1.47)	-	-0.2171 (-1.38)	-0.2169 (-1.41)	-	-0.2236 (-1.74)	-0.2162 (-1.52)	-	-0.1905 (-1.17)	-0.1837 (-1.21)	-	-0.8494 (-1.78)	-0.9215 (-2.06)
β_{MOM}				-	-	0.2699 (2.32)	-	-	-0.0100 (-0.04)	-	-	0.1159 (0.46)	-	-	0.2072 (1.16)	-	-	0,3919 (0,63)
Adj. R^2				0.0133	0.0285	0.0873	0.0137	0.0286	0.0174	-0.0101	.0037	-0.0012	-0.0032	-0.0061	0.0008	0.0562	0,0782	0,0692
Panel B. Ranking period: 6 months																		
	Holding period: 1 month			Holding period: 3 months			Holding period: 6 months			Holding period: 9 months			Holding period: 12 months			Holding period: 36 months		
	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4
α	0.0126 (2.49)	0.0099 (1.79)	0.0100 (1.93)	0.0103 (2.81)	0.0107 (2.74)	0.0096 (2.50)	0.0096 (3.06)	0.0100 (2.91)	0.0091 (2.56)	0.0094 (2.82)	0.0114 (3.68)	0.0091 (2.94)	0.0087 (2.30)	0.0110 (2.54)	0.0083 (2.09)			
β_{MKT}	-0.4951 (-2.58)	-0.5125 (-2.62)	-0.3285 (-1.70)	-0.2296 (-0.94)	-0.2350 (-0.93)	-0.1005 (-0.40)	-0.0275 (-0.49)	-0.0270 (-0.49)	-0.0220 (-0.40)	-0.1601 (-0.86)	-0.1935 (-1.00)	-0.0287 (-0.17)	-0.1059 (-0.54)	-0.1512 (-0.71)	0.0516 (0.35)			
β_{SMB}	-	0.3013 (1.69)	0.1123 (0.70)	-	-0.0089 (-0.05)	-0.0627 (-0.38)	-	-0.0254 (-0.07)	0.0126 (0.04)	-	-0.0201 (-0.05)	0.0793 (0.24)	-	-0.0669 (-0.12)	0.0945 (0.23)			
β_{HML}	-	0.1604 (0.93)	0.0820 (0.45)	-	-0.0474 (-0.37)	-0.0125 (-0.08)	-	-0.0283 (-0.18)	-0.0324 (-0.20)	-	-0.2040 (-0.99)	-0.1706 (-0.92)	-	-0.2114 (-0.64)	-0.1898 (-0.74)			
β_{MOM}	-	-	0.3431 (3.59)	-	-	0.2859 (2.19)	-	-	0.1696 (0.59)	-	-	0.5218 (3.35)	-	-	0.6560 (3.86)			
Adj. R^2	0.1496	0.1727	0.2756	0.0368	0.0165	0.0702	-0.0082	-0.0308	-0.0256	0.0155	0.0145	0.1244	-0.0002	-0.0048	0.1326			

Table 6b. OLS estimates for the observations with 9-12-month ranking period in the sub-sample 2000-2007

Panel C. Ranking period: 9 months																		
	Holding period: 1 month			Holding period: 3 months			Holding period: 6 months			Holding period: 9 months			Holding period: 12 months			Holding period: 36 months		
	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4
α	0.0132 (2.68)	0.0105 (2.01)	0.0106 (2.17)	0.0120 (3.18)	0.0129 (3.35)	0.0114 (2.97)	0.0129 (3.23)	0.0163 (3.76)	0.0133 (2.96)	0.0111 (2.72)	0.0180 (4.28)	0.0154 (3.66)	0.0103 (2.35)	0.0204 (4.64)	0.0174 (4.04)			
β_{MKT}	-0.4967 (-2.66)	-0.5258 (-2.87)	-0.3283 (-1.85)	-0.4695 (-3.02)	-0.4959 (-3.47)	-0.3095 (-2.24)	-0.0744 (-1.26)	-0.0699 (-1.42)	-0.0520 (-1.13)	-0.3674 (-1.59)	-0.4620 (-2.93)	-0.2772 (-2.30)	-0.2709 (-0.96)	-0.4568 (-2.80)	-0.2359 (-2.66)			
β_{SMB}	-	0.3311 (2.17)	0.1286 (0.98)	-	0.0405 (0.24)	-0.0341 (-0.20)	-	-0.1505 (-0.35)	-0.0128 (-0.04)	-	-0.2484 (-0.59)	-0.1369 (-0.41)	-	-0.5299 (-0.99)	-0.3541 (-0.96)			
β_{HML}	-	0.1383 (0.91)	0.0543 (0.35)	-	-0.1227 (-0.97)	-0.0742 (-0.50)	-	-0.2858 (-1.35)	-0.3007 (-1.39)	-	-0.5975 (-2.27)	-0.5601 (-2.40)	-	-0.8079 (-2.82)	-0.7844 (-3.31)			
β_{MOM}	-	-	0.3677 (4.07)	-	-	0.3963 (3.23)	-	-	0.6154 (3.55)	-	-	0.5850 (3.90)	-	-	0.7146 (4.51)			
Adj. R^2	0.1618	0.1988	0.3274	0.2024	0.1947	0.3189	0.0139	0.0464	0.2936	0.1341	0.3176	0.4654	0.0698	0.3815	0.5614			
Panel D. Ranking period: 12 months																		
	Holding period: 1 month			Holding period: 3 months			Holding period: 6 months			Holding period: 9 months			Holding period: 12 months			Holding period: 36 months		
	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4	CAPM	FF3	FF4
α	0.0117 (2.32)	0.0109 (1.94)	0.0110 (2.07)	0.0121 (2.90)	0.0160 (3.60)	0.0143 (3.27)	0.0118 (2.62)	0.0184 (3.80)	0.0153 (3.08)	0.0100 (2.17)	0.0204 (4.42)	0.0180 (3.85)	0.0091 (1.83)	0.0221 (4.56)	0.0191 (3.97)			
β_{MKT}	-0.4768 (-2.48)	-0.5330 (-2.81)	-0.3479 (-1.84)	-0.4521 (-2.34)	-0.5033 (-2.97)	-0.2970 (-1.86)	-0.0820 (-1.08)	-0.0732 (-1.33)	-0.0549 (-1.02)	-0.3550 (-1.20)	-0.4821 (-3.01)	-0.3090 (-2.49)	-0.1931 (-0.53)	-0.4288 (-2.28)	-0.2083 (-1.66)			
β_{SMB}	-	0.2323 (1.44)	0.0423 (0.29)	-	-0.0526 (-0.27)	-0.1352 (-0.74)	-	-0.3561 (-0.83)	-0.2150 (-0.70)	-	-0.5573 (-1.36)	-0.4528 (-1.36)	-	-0.7335 (-1.38)	-0.5581 (-1.44)			
β_{HML}	-	-0.0378 (-0.20)	-0.1167 (-0.59)	-	-0.4089 (-2.22)	-0.3552 (-1.99)	-	-0.5275 (-2.39)	-0.5427 (-2.48)	-	-0.8260 (-3.25)	-0.7909 (-3.32)	-	-1.0099 (-3.72)	-0.9864 (-3.98)			
β_{MOM}	-	-	0.3451 (3.74)	-	-	0.4387 (3.86)	-	-	0.6304 (3.67)	-	-	0.5481 (3.77)	-	-	0.7133 (4.06)			
Adj. R^2	0.1410	0.1620	0.2683	0.1569	0.2106	0.3402	0.0155	0.1704	0.3989	0.1102	0.4732	0.5894	0.0238	0.4619	0.6161			

Notes: The models testes are the CAPM, Fama and French 3-factor model and Carhart model. In the last row the adjusted Theil R^2 is reported.