International Price and Earnings Momentum*

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ABSTRACT

We find that price and earnings momentum are pervasive features of international equity markets when controlling for data snooping biases. For European countries, we find that price momentum is subsumed by earnings momentum on an aggregate level. However, this rationale does not apply to each and every country. While the above explanation is confined to certain time periods in the U.S., earnings momentum nevertheless appears to be a crucial driver of the price momentum anomaly in many markets. Since we cannot establish a decent relation between momentum and macroeconomic risks, we suspect a behavioral-based explanation to be at work. In fact, we find momentum profits to be more pronounced for portfolios characterized by higher information uncertainty. Hence, the momentum anomaly may well be rationalized in a model of investors underreacting to fundamental news. Finally, we find that momentum works better when limited to stocks with high idiosyncratic risk or higher illiquidity, suggesting that limits to arbitrage deter rational investors from exploiting the anomaly.

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JEL Classification: G11; G12; G14; M40

According to the Oxford Dictionary momentum is a force that is gained by movement. Price momentum entails the observation that past winning stocks continue to deliver superior returns in the short run while past losing stocks subsequently continue to disappoint. Likewise, earnings momentum refers to the observation of momentum in stock prices following the direction of analysts' earnings forecast revisions. Both phenomena have been documented for the U.S. by Jegadeesh and Titman (1993) and Chan, Jegadeesh, and Lakonishok (1996) in the early nineties. Moreover, Rouwenhorst (1998) and Griffin, Ji, and Martin (2003, 2005) evidence that the momentum effect carries over to many developed international markets in terms of magnitude and persistence.

Within this paper we confirm that price and earnings momentum are constantly defying capital market efficiency in international equity markets. Usually, this observation is being rationalized by either risk-based or behavioral-based explanations, however, such explanations are only meaningful if the momentum anomaly is not spurious in the first place. Especially, when a vast number of strategies is being tested around the globe, some strategies tested may excel by chance alone. Statistically speaking, there is a need to control for data snooping biases given the multitude of tests involved. While researchers have long been aware of data snooping biases, see Lo and MacKinlay (1990), Sullivan, Timmermann, and White (1999) and White (2000), common statistical procedures are not always optimal in terms of power, and hence they are most likely to reject any given anomaly. However, we aim to detect as many countries as possible where the momentum anomaly actually exists. We therefore employ the recent proposal of Romano and Wolf (2005), which achieves improvements in power due to its stepwise nature and use of studentized test statistics. As a major contribution of this paper we find that both price and earnings momentum are fairly persistent with regard to data snooping biases, rendering the phenomenon even more intriguing. Especially, the need for a sound economic explanation of the origins of momentum is apparent.

In examining the link between both momentum anomalies we test the recent conjecture of Chordia and Shivakumar (2006) who claim that price momentum is merely a noisy proxy for earnings momentum in the U.S. This explanation is intuitive since price momentum may well be rationalized in a model of investors underreacting to fundamental news as represented by earnings revisions. Along this line of reasoning we check whether this explanation constitutes a broad pattern in a large sample of 16 European countries. Our results are as follows: First, while

we replicate the result of Chordia and Shivakumar (2006) for their sample period ending in 1999, conjectured pattern has recently become more subtle. During the market frenzy at the end of the nineties, we observe a decoupling of price and earnings momentum in the U.S, which suggests that this period may be dominated by investors' over- instead of underreaction. Second, considering an aggregate European momentum strategy, we find that European price momentum appears to be a manifestation of earnings momentum throughout the whole twenty year sample period. Third, while we cannot replicate this argument in all European countries, there is considerable evidence that earnings momentum is a crucial determinant in explaining price momentum for most countries.

Having established a link between both anomalies we are still in need of a deeper momentum rationale. In further examining the international momentum phenomena we fail to establish momentum as a proxy for macroeconomic risk. Rather supporting a behavioral-based argument, we find momentum strategies to be most profitable when restricted to winner and loser portfolios characterized by proxies of high information uncertainty. In other words, the noisier the fundamental information, the slower its incorporation into prices, which is in accordance with underreaction of investors.

Regardless of the origins of momentum, be it risk or behavioral biases, it is most puzzling why this anomaly is not arbitraged away. While various market anomalies are found to falter following their publication, see Schwert (2003), momentum does not. Explaining this observation Korajczyk and Sadka (2004) and Lesmond, Schill, and Zhou (2004) detect trading costs to be the single most important impediment to successfully implementing momentum strategies in the U.S.. The amount of trading costs is not only driven by the huge turnover but also by liquidity risk, hence, Chordia, Goyal, Sadka, Sadka, and Shivakumar (2007) accordingly find the post-earnings-announcement drift to be confined to illiquid securities. Even more so, Liu (2006) constructs a liquidity-augmented asset pricing model that almost captures the abnormal returns of standard U.S. price momentum strategies. In a related vein, Arena, Haggard, and Yan (2008) resolve this puzzle for the U.S. by showing that momentum profits are especially pronounced for stocks with high idiosyncratic volatility which suggests that the momentum phenomenon persists since any arbitrageur wishing to exploit the anomaly is limited by high arbitrage costs. In substantiating

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this claim we provide additional evidence that international momentum strategies appear to be mostly limited to highly illiquid stocks.

The paper's structure is as follows. In Section I, we review prior evidence on the momentum anomalies both in the U.S. and in European markets. Section II presents the data we use for our study. In Section III, we establish the traditional analysis of momentum anomalies in European equity markets. In Section IV, we subject both anomalies to recent methods of multiple testing. Section V examines the interplay of both anomalies. Section VI further explores the link of momentum to the macroeconomy and its interaction with information uncertainty and liquidity. Section VII concludes.

I. Review of Momentum Strategies

A. Price Momentum

Momentum in individual stock prices has first been documented by Jegadeesh and Titman (1993) and their approach to quantify price momentum has become the industry standard. They consider a portfolio that is long in the winner decile and short in the loser decile. These decile portfolios arise from several winner and loser portfolios based on overlapping time periods. The stocks are ranked monthly according to their performance over the last six months and assigned accordingly to the respective quintile portfolios. These are held for six months. Hence, the winner or loser decile of the associated price momentum strategy of a given month is made up of six portfolios. Jegadeesh and Titman (1993) find such a price momentum strategy to earn more than 1% above the risk-free rate per month. Even though the decile portfolios usually consist of smaller sized companies with high beta risk, the associated hedge strategy's return cannot be fully explained by significant size or market exposure. The fact that the momentum anomaly is not arbitraged away and still persists is even more intriguing, see Jegadeesh and Titman (2001).

In explaining the phenomenon of U.S. price momentum, Jegadeesh and Titman (2001) examine post-holding period return patterns of momentum portfolios. These patterns favor a behavioral explanation of momentum to be triggered from market participants' under- or overreaction to new information. Overreaction will drive stock prices to levels that are not fundamentally justified,

giving rise to a subsequent reversion back to their initial level. On the other hand, given limited information processing capabilities, investors may underreact to news which may positively effect a company's fundamental value. Since overconfidence likely causes investors to cling to their original views, this fundamental news may only gradually transmit into the company's stock price. In this case, one obtains a flat post-holding period return to a momentum strategy.

Not only is the price momentum anomaly confined to the U.S., it has also been documented in several international studies, such as in Rouwenhorst (1998) for Europe and more recently in Griffin, Ji, and Martin (2003, 2005) for a large set of countries. While Rouwenhorst (1999) finds emerging markets to exhibit price momentum, Bekaert, Erb, Harvey, and Viskanta (1997) contend that momentum in these markets are less consistently profitable.

B. Earnings Momentum

Ball and Brown (1968) have first documented the phenomenon of post-earnings announcement drift which encompasses the tendency of stock prices to drift in the direction suggested by recent earnings surprises. This observation is most likely caused by irrational investors failing to fully appreciate the earnings information, which results in a delayed price response, see Bernard and Thomas (1989). While studies on the post-earnings announcement drift rely on some measure of realized earnings surprise, one may also resort to analysts' earnings forecasts as a more direct measure of earnings expectations. Doing so provides a more timely measure, given that non-U.S. companies usually report earnings on an annual basis as opposed to quarterly reporting. The investment strategy building on the above metric is typically referred to as earnings momentum.

The implementation of the earnings momentum strategy is similar to the one of price momentum. However, companies are not being ranked dependent on the level of prior returns but prior earnings revisions. As in Chan, Jegadeesh, and Lakonishok (1996), we build a moving average of cumulated revisions over the prior six months to capture the change in earnings expectations:

$$REV6_{it} = \sum_{j=0}^{6} \frac{f_{it-j} - f_{it-j-1}}{p_{it-j-1}} \qquad (1)$$

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where f_{it} is the consensus I/B/E/S estimate in month t of the i-th company's earnings for the current fiscal year, as provided by the Institutional Brokers' Estimate System (I/B/E/S) The resulting difference, the monthly revision, is then scaled by the prior month's stock price. We go long in the highest earnings revisions quintile and short in the lowest quintile in any given month according to the value of $REV6_{it}$. Given a holding period of six months, the resulting hedge strategy's long leg consists of six overlapping portfolios, as does the short leg.

C. Linking Price and Earnings Momentum

It is straightforward to speculate as to whether price and earnings momentum may reflect the very same mispricing or behavioral bias. In fact, prior studies like Chan, Jegadeesh, and Lakonishok (1996) find that the U.S. momentum effect is concentrated around subsequent earnings announcements and show that price momentum may partially be explained by underreaction to earnings information. However, they contend that price momentum is not subsumed by earnings momentum since each ranking variable has some incremental predictive power for future returns. This view is shared by Griffin, Ji, and Martin (2005) who analyze both momentum strategies in an international context. Given that Hong and Swaminathan (2003) only detect price momentum in countries that also exhibit earnings momentum nevertheless makes the case for a closer relation of the two anomalies. Indeed, Chordia and Shivakumar (2006) show that U.S. price momentum appears to be a manifestation of earnings momentum.

II. Data

A. Sample Selection

We use a comprehensive sample of companies domiciled in 17 equity markets, 16 European markets and the U.S., covering the period from 1987 to 2007. All data has been gathered from Datastream including I/B/E/S earnings revisions data.

Table ?? contains information on the sample countries classified by region. We collect companies for each country by merging the live and dead research lists provided by Datastream on July 2nd, 2007 and thereby obtain a total number of 65,925 companies. To arrive at our final sample,

we have pruned the initial country research lists as follows. First, we adjust each country list for secondary issues and cross-country listings to prevent double-counting. In particular, we extract 30,552 companies. Hence, only one half of the initial list does refer to major listings. Second, we screen for non-equity issues, i.e., we exclude investment trusts, ADRs, and the like. Third, we also exclude OTC stocks and stocks that are only listed on regional exchanges. Following these two screens 16,662 companies remain. We further exclude those having market capitalization below 10 million USD, which leaves us with a final sample of 13,291 companies. Almost one half are U.S. companies and the biggest five markets comprise some 80%. To avoid survivorship bias, the sample includes 4,550 "dead" companies, i.e., one third of the whole sample, ranging from 16.9% for Greece to 52.2% for Portugal. The label "dead" applies to companies in extreme distress and to those being merged, delisted, or converted.

Since we aim to investigate price and earnings momentum strategies, we additionally check the coverage of return and earnings revisions data. Unsurprisingly, the coverage for return data is close to 100% in each country, on average 98.4% of the companies do exhibit at least one return observation over the course of the sample period. As for the earnings estimates, these figures are more fragmentary. However, the average coverage still amounts to 75.5% spanning a range from 62.6% (Belgium) to 94.1% (Spain). Note that our sample contains a certain amount of penny stocks that will not be included in the momentum strategies. We do not discard them right away, since being a penny stock is not a static firm characteristic. In particular, we do not invest in companies with stock price below 5$ at the beginning of a given month. To give an idea of the investment universe's size over time, we provide the absolute number of companies to be considered for the momentum strategies across countries in Table II. All in all, we have 59,394 firm-years for the momentum strategies of which one half is concentrated in the U.S. (32,905 firm-years), followed by France (4,255 firm-years) and the U.K. (4,188 firm-years). Note that the number of available companies increased over the years. However, the 1999 peak is followed by a slight setback.

B. Return Data

We consider monthly stock returns in local currency inclusive of dividends by employing total return figures. To represent the respective markets, we choose broad market indices as compiled by Datastream and 3-month-T-bills serve as a proxy for the risk-free rate.

Ince and Porter (2006) show that the price momentum effect cannot be detected in the U.S. when naïvely using raw Datastream data, an observation that appears to extend to other international markets as well, see Leippold and Lohre (2008). For curing these data issues, Ince and Porter (2006) propose two major adjustments. One is to remove non-common equity from the respective country research lists and the other is to screen for irregular return patterns. Since the former has already been dealt with when deleting secondary issues, we merely have to address the quality of return data. We follow Ince and Porter (2006) in adjusting the return data to allow for reasonable statistical and economic inferences.

Interestingly, we find our comprehensive sample to be hardly confounded by erroneous return data. For instance, the U.S. only requires to change 99 return observations which represents 0.01% of all observations. This fraction is even smaller for Europe for which we adjust 54 observations across all 16 countries. We assume that Datastream has significantly corrected the database in response to the objections of Ince and Porter (2006). Still, the remaining issues might severely affect statistical inferences and weeding them out renders us even more comfortable with the quality of data.

III. Detecting Price and Earnings Momentum

A. Risk and Return

We next report descriptive statistics of momentum-based quintile portfolios by country. In computing momentum portfolio returns, we follow the standard approach of Jegadeesh and Titman (1993) that stipulates the use of overlapping portfolios as described in the previous section. Tables III and IV give average monthly buy-and-hold return and volatility figures together with two risk proxies, size and beta.

First, we assess the profitability of the price momentum hedge strategy by considering the return differential along with its t-statistic. For the U.S., we obtain a monthly hedge return of 79 basis points at a monthly volatility of 4.4% giving rise to a t-statistic of 2.80. The latter is even higher for the European hedge strategy providing a return of 119 basis points per month but at a lower volatility. Further, using the t-statistic metric, we identify 12 European countries that have anomalous returns on a 5% level or better. If we relax the significance level to 10%, Norway appears to be anomalous as well, leaving Austria, Ireland, and Spain as the only countries for which price momentum is not significant, albeit positive. All in all, we recover prior evidence of pronounced international momentum effects as documented by Rouwenhorst (1998) and Griffin, Ji, and Martin (2003, 2005).

While the loser quintile is sometimes contributing to the return spread, we note that the lion's share is due to the winner quintile. This finding confirms prior evidence that a long-only investor may well benefit from an according momentum strategy. However, the extreme quintile portfolios are the riskiest across all countries, since the winner and loser portfolios prove to be more volatile than the portfolios with less extreme price momentum. To judge a systematic risk bias of these portfolios, we compute betas according to the classical regression

$$R_{it} - R_{Ft} = \alpha_i + \beta_i(R_{Mt} - R_{Ft}) + \varepsilon_{it}, \tag{2}$$

where R_{it} denotes the gross return of quintile i, R_{Ft} is the risk-free rate and R_{Mt} is the market return of the respective country. For more than half of the countries, the extreme quintile portfolios exhibit high betas, while the remaining portfolios appear to be homogeneous in terms of beta. Moreover, in 14 countries we obtain the highest betas for the loser quintile. Also, there is a size bias for the two extreme quintile portfolios. When we examine size, measured in terms of the logarithm of market value, we find that the two extreme portfolios are mostly populated by smaller companies. Again, the bias is more severe in the loser quintile, which may in turn explain its conspicuous market exposure. Concerning the price momentum strategy, we usually observe betas that are slightly negative suggesting that one may partially hedge against downside moves of the market.

Regarding earnings momentum, the U.S. strategy earns 58 basis points per month at a volatility that is only half the size of the price momentum volatility. Thus, the according t-statistic of 4.11 is more convincing. This observation of improved risk-adjusted performance also applies to the European earnings momentum strategy with a return of 83 basis points per month at 1.71% volatility, giving a t-statistic of 7.52. Across Europe, Tables III and IV give rise to 13 significant return differentials while the remaining countries also show positive differentials. These usually reflect the general pattern of price momentum outperforming earnings momentum in terms of return at the cost of higher volatility. Even though earnings momentum exhibits less volatility, risk-mitigating effects with regard to market volatility do only occur in some countries. Compared to price momentum, these earnings momentum differentials seem to be driven less often by the short leg. Again, the extreme quintile portfolios are more risky than the middle portfolios. However, in contrast to price momentum the long leg has less beta exposure while the short leg of the earnings momentum strategy has a large exposure to this factor. Also, the earnings momentum strategy exhibits negative betas that are usually lower than those of the according price momentum strategy.

[Figure 1 about here.]

In the upper graphs of Figure 1, we plot the cumulative returns of the winner and loser quintiles of the earnings and price momentum strategies together with the evolution of an equally-weighted market portfolio. By inspecting the cumulative wealth of the extreme quintiles for the U.S., we find already strong support for the findings in Chordia and Shivakumar (2006), namely that price and earnings momentum are closely related. For both earnings and price momentum, the loser and the winner quintile portfolios move almost in sync. In addition, the loser portfolio stays well below the market portfolio and the winner portfolio stays well above it. We observe a similar behavior in Europe. However, both legs of the price momentum strategy are shifted upwards as compared to their earnings momentum counterparts.

Also, inspecting the cumulative momentum returns for the U.S. and Europe over time in the lower graphs of Figure 1 confirms the above statements. Both, price and earnings momentum, seem to be closely tied. Over the nineties, the respective return paths nearly coincide. However, the earnings momentum strategy is smoother. While this observation has already been deduced

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from the descriptive statistics, we additionally learn that the higher volatility figures mainly arise over a short period following the burst of the technology bubble in 1999. Hence, though usually sailing in safe waters, a price momentum investor may experience very turbulent times with volatility well in excess of common market levels.

B. Time-Series Regressions

Since most of the hedge strategies are highly volatile, we wonder whether their high returns are solely compensating for risk. To further examine the performance of our strategies, we therefore check if the long-short portfolio returns can be attributed to common risk factors. We adopt the standard approach of Fama and French (1993) and estimate a regression model of the form

$$R_{Lt} - R_{St} = \alpha + \beta(R_{Mt} - R_{Ft}) + \gamma R_{SMBt} + \delta R_{HMLt} + \varepsilon_t, \tag{3}$$

where $R_{Lt} - R_{St}$ is the return difference of the respective hedge strategy, i.e., the long leg minus the short leg. Regarding the common risk factor portfolios we compute country-specific factors as follows: The market return R_{Mt} is represented by some broad market index, the size factor R_{SMBt} is mimicked by a small cap index minus the risk-free rate, $R_{SCt} - R_{Ft}$, and the value factor R_{HMLt} is the difference between a value index and the corresponding growth index, $R_{Vt} - R_{Gt}$. Given the factor structure in (3), we can identify the alpha generated by the hedge strategy net of common risk factors.

Table V displays the results of a Fama-French regression for price momentum according to equation (3) that uses 240 monthly returns spanning the period from July 1987 to June 2007. Across all countries, the risk factors explain most of the variation of the loser and winner quintiles' excess returns, thus confirming our descriptive analysis in the previous section. However, concerning the long-short strategies, we note that the model's explanatory power is generally low, confirming prior evidence as in Fama and French (1996). The resulting alphas are positive and significant at the 5%-level for 15 out of 17 countries, whereas Ireland and Austria are the exception to the rule. Note that the hedge strategies are also promising in terms of economical significance. Except for Austria, Ireland, and Spain, 14 countries generate monthly alphas in excess of 90 basis points, the Greek alpha even amounts to 217 basis points, followed by 134 basis

points for Denmark and 128 basis points for Germany. Across countries, we note that the alphas are mostly driven equally by the long and the short leg, with a slight tendency towards the long leg. However, the U.S. alpha of 101 basis points is almost entirely due to the short leg.

Table VI gives the analogous results of the Fama-French regression for earnings momentum which is not captured by common risk factors as well. All countries exhibit positive alphas that are significant on a 5%-level in 16 cases—the odd one out is Greece. Hence, this analysis significantly hardens our pure return diagnostics. As for the sources to the earnings momentum alphas, we note that long and short legs contribute in equal shares.

To further examine the evolution of both hedge strategies over time, we compute the related alphas for the U.S. and Europe via trailing Fama-French regressions according to equation (3). We use a 36-month window and plot the resulting alphas in the upper graphs of Figure 2 for price momentum and in the lower graphs of Figure 2 for earnings momentum. To address statistical significance, we additionally provide 95% confidence bands. Regarding price momentum, the hedge strategies' alphas prove to be consistently positive throughout the sample period. While the evolution of price momentum alphas is rather volatile, earnings momentum alphas behave more steadily. Interestingly, the U.S. momentum strategies have experienced severe drawdowns at the end of the nineties while European momentum strategies have not faltered.

[Figure 2 about here.]

IV. Momentum Strategies and Data Snooping

From the previous section we learn that 15 out of 17 countries exhibit positive and significant price momentum alphas and 16 exhibit positive and significant earnings momentum alphas. However, these alphas may be spurious since they arise from single hypothesis tests performed for each country. Therefore, we will subject both momentum strategies to recent econometric methods that additionally account for multiple testing. These testing procedures either control for the *familywise error rate* (FWE) or the *false discovery proportion* (FDP). Below, we will briefly introduce the concept behind these methods.

A. Accounting for Multiple Testing

When simultaneously testing several, say S, trading strategies against a common benchmark, some strategies may outperform others by chance alone. For instance, extensive re-use of a given database or testing one investment idea on various markets of similar nature are prime examples. The latter case applies to our setting since we wish to detect anomalies in several equity markets simultaneously.[1] Therefore, we must combine the individual hypotheses into multiple testing procedures that control for the possibility of data-snooping biases.[2]

A.1. Methods Based on the FWE

The traditional way to account for multiple testing is to control the familywise error rate, defined as the probability of rejecting at least one of the true null hypotheses. If this objective is achieved, one can be confident that all hypotheses that have been rejected are indeed false (instead of some true ones having been rejected by chance alone). Many methods that control the FWE exist, the simplest one being the well-known Bonferroni (1936) method, which consists of a plain p-value adjustment, i.e., the initial significance level α is divided by the number of hypotheses under test. Evidently, this method is strict and would result in an outright rejection of any momentum anomaly in all countries. However, it is also important to use a method that provides as much power as possible so that false hypotheses have a chance of being detected.

Romano and Wolf (2005) note that the conservativeness of classical procedures like the one of Bonferroni (1936) is due to the fact that these methods assume a worst-case dependence structure of the test statistics. For instance, if we consider the extreme case of all hedge strategies yielding the very same alpha, then individual tests should be carried out at the level α, which obviously is more powerful than the Bonferroni (1936) method. Hence, accounting for the true dependence structure is important. In our set-up, we would like to detect as many countries as possible where the momentum anomaly actually exists. In this respect, the recent proposal of Romano and Wolf (2005) appears to be the state of the art. On the one hand, it improves upon Bonferroni-type methods based on the individual p-values by incorporating the dependence structure across test

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[1] Parmler and González (2007) examine data snooping biases in price momentum following a different route. They subject several variants of the U.S. price momentum strategy to the bootstrap reality check of White (2000) and conclude that momentum is robust along this dimension.

[2] For an overview, see Lehmann and Romano (2005, Chapter 9).

statistics. On the other hand, it improves upon the bootstrap reality check of White (2000) by incorporating a stepwise approach and by employing studentized test statistics. We briefly describe this k-StepM method in Appendix A which ultimately returns a confidence region for the return or the alpha.

A.2. Method Based on the False Discovery Proportion (FDP)

When the number of hypotheses under test is very large, the error control may be based on the false discovery proportion rather than on the familywise error rate. Let F be the number of false rejections arising from a multiple testing method and let R be the total number of rejections. We define the FDP as the fraction F/R, given that $R > 0$. Otherwise, the FDP is zero. A multiple testing method controls the FDP at level α if $P(\text{FDP} > \gamma) \leq \alpha$, for any P, at least asymptotically. Typical values of γ are 0.05 and 0.1.

Romano, Shaikh, and Wolf (2008) present a generalized version of the StepM method that allows for controlling the FDP, the FDP-StepM$_\gamma$ method. The method is somewhat complex and the reader is referred to the paper for the details. However, the first step of the method is easy to understand and works as follows. Consider controlling the FDP with $\gamma = 0.1$. The method starts with applying the StepM method. If less than nine hypotheses are rejected, the method stops. If nine or more hypotheses are rejected, the method continues and some further hypotheses might be rejected subsequently.

Romano, Shaikh, and Wolf (2008) compare the k-StepM method to competing methods by means of a simulation study and two empirical applications. They find that all of the methods provide control of the respective error rates. However, the FWE control is too strict, but generalized error rates such as the k-FWE or the FDP allow for more power. Also, the StepM methods turn out to be more powerful than those methods that do not account for the dependence structure of test statistics. Therefore, the methods related to StepM are most suitable for our purpose.

B. Is Momentum Due to Data Snooping?

Reconciling the results of the traditional analysis, we are left with 15 positive and significant price momentum alphas and 16 positive and significant earnings momentum alphas. Since this

result could have occurred by chance alone, we need to account for multiple testing issues using the methods presented above.

To control the FWE, we consider the k-StepM method for $k = 1$ which is the appropriate choice given the number of strategies under study. To control the FDP, we pursue the FDP-StepM$_\gamma$ using $\gamma = 0.1$. We keep the significance level constant at 5% across all multiple testing procedures and we present results for the return of the hedge strategies as well as their alphas arising from the Fama-French time series regressions. To account for potential serial correlation in the return series, we use a kernel variance estimator based on the Parzen kernel to studentize the test statistics, see Andrews (1991). The bootstrap method is the stationary bootstrap with an average block size of 12 months.[3]

Panel A of Table VII reports the countries' return statistics for price momentum. We provide the lower confidence band c_l for the returns using studentized test statistics according to the StepM and FDP-StepM$_\gamma$ method, respectively. Since we are in a one-sided test setting, we give the lower limits of the confidence interval as computed in the last step of the respective method. The value in the column labeled rej equals 1 if $0 \notin [c_l, \infty)$, which indicates the rejection of capital market efficiency and suggests the presence of an anomaly in the respective country.

Concerning the results for the price momentum returns, we observe 13 rejections by the StepM method. Thus, the FDP-StepM$_\gamma$ is not equivalent to the StepM, since the number of rejections exceeds nine. Moreover, the FDP-StepM$_\gamma$ rejects market efficiency for 15 countries.

Panel B of Table VII displays the multiple testing results using the Fama-French price momentum alphas as test statistics. With this metric, price momentum is found to be overwhelmingly robust to data snooping. Already the StepM method yields 16 rejections of capital market efficiency. Hence, the results mirror those of the naïve screen that are also obtained using the FDP-StepM$_\gamma$.

As for the earnings momentum strategies, Table VII reveals results that are qualitatively similar to the ones obtained for price momentum. However, considering returns as test statistic, the StepM gives only nine rejections of capital market efficiency, while the FDP-StepM$_\gamma$ method

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[3]Using the stationary bootstrap with an average block size of 6 months leaves results virtually unchanged.

rejects 16 countries. Considering alphas as test statistic, the StepM method detects 15 and the FDP-StepM$_\gamma$ method 16 significant alphas.

To conclude, the detected price and earnings momentum anomalies are confirmed by our battery of tests that account for multiple testing issues. By and large, both phenomena prove to be quite persistent and raise the need of sound economic inference.

V. Linking Price and Earnings Momentum

Having ruled out data snooping biases as possible explanations to the momentum effects, we will further delve into the economic nature of these phenomena. In fact, one may wonder whether both price and earnings momentum may be traced back to similar sources, be it a behavioral bias or a compensation for risk.

A. Correlation of Price and Earnings Momentum

When inspecting the cumulative returns in Figure 1, we have already noted that price and earnings momentum do follow very similar return paths. To quantify this similarity, we simply compute the correlation of selected price and earnings momentum portfolios in Table VIII. In particular, we compare portfolios with identical price and earnings momentum ranking. For instance, in the U.S. we observe a correlation of 0.933 between the loser portfolio and the portfolio with the lowest earnings revisions. The winner portfolio is also highly correlated with the highest earnings revision portfolio, exhibiting a correlation of 0.902. Unsurprisingly, these figures are significantly different from zero. Moreover, this relation also holds in the remaining countries with the same order of magnitude. Most of the correlations range between 0.8 and 0.95. However, among the different countries' quintile portfolios, the winner quintiles usually have the smallest correlation.

Given these results, we suspect the price and earnings momentum hedge strategies to be positively correlated as well. Indeed, while Greece unsurprisingly exhibits rather zero correlation, all of the remaining time series of returns exhibit significantly positive correlation with correlation coefficients between 0.161 and 0.670. Among the 17 countries we find ten (seven) with correlation

in excess of 0.3 (0.4). We also compute the correlation of price and earnings momentum alphas using the respective time-series arising from the trailing Fama-French regressions of Section III. While the resulting correlation figures often exceed those of the return time series, Spain has a negative correlation and for two countries, the alphas' correlation is not distinguishable from zero. These countries are Greece and the U.S.. Especially for the U.S., this observation is unanticipated given a return time series correlation of 0.319. Nevertheless, the general pattern of alpha correlations is consistent with the return correlations, giving 15 significant figures ranging from 0.224 (Switzerland) to 0.630 (France).

B. Does Earnings Momentum Subsume Price Momentum?

So far we have compiled considerable evidence that price and earnings momentum are closely connected in the U.S. and several European markets. In fact, Chordia and Shivakumar (2006) show that the U.S. price momentum alpha vanishes when additionally controlling for earnings momentum, while the U.S. earnings momentum alpha is robust when vice versa controlling for price momentum. Chordia and Shivakumar (2006) thus reason that price momentum is just a noisy proxy for earnings momentum. While this reasoning is quite persuasive, we wonder whether this observation carries over to other markets. Therefore, when testing for price momentum, we extend the Fama-French setting of Equation (3) to a four-factor model by adding an earnings momentum factor:

$$R_{Lt} - R_{St} = \alpha + \beta(R_{Mt} - R_{Ft}) + \gamma R_{SMBt} + \delta R_{HMLt} + \zeta R_{PMNt} + \varepsilon_t, \qquad (4)$$

where R_{PMNt} refers to the returns to the earnings momentum strategy (positive minus negative earnings revisions). Accordingly, Table IX contrasts the Fama-French results to those of the above four-factor model for all countries' respective hedge strategies. For the U.S. and the aggregate European strategy we additionally give the results for the quintile portfolios. While the returns of the quintile portfolios are usually reasonably captured by the Fama-French factors, the returns of the price momentum strategies are not. Even though these strategies sometimes load to one common factor or another, the adjusted R^2s are typically quite low. Only for the U.K., France, and Germany do we observe two-digit adjusted R^2s.

Considering the alphas of quintile portfolios, we note a monotonic increase from loser to winner portfolios. For instance, the monthly U.S. price momentum alpha of 101 basis points results from -90 basis points for the loser quintile and from 11 basis points from the winner quintile. However, this huge spread is fairly persistent when controlling for the earnings momentum factor. The loser quintile's alpha is -80 basis points and the winner quintile's alpha reduces to 1 basis point. As a consequence, the U.S. price momentum is still significant under the four-factor model, contrasting with the results of Chordia and Shivakumar (2006).

The general pattern in Europe is different. For instance, for the European strategy we observe the following. While the Fama-French model attains an adjusted R^2 of 9.4%, the four-factor model explains 42.9% of the variation in European price momentum returns, cutting down the Fama-French alpha of 146 basis points to insignificant 16 basis points. Across all countries, the addition of the earnings momentum strategy in (4) seems reasonable, since many portfolios exhibit significant loadings to this factor. In particular, the adjusted R^2 of the hedge strategies usually increases by a considerable amount. In this sense, all countries' price momentum alphas are clearly reduced in the four-factor model and so are the corresponding t-statistics. The latter reductions imply statistical insignificance in seven out of 16 European countries: The price momentum alphas of Germany, Switzerland, France, Spain, Portugal, the Netherlands, and Finland are subsumed by the respective earnings momentum factor.

According to Chordia and Shivakumar (2006), for earnings momentum to be the crucial driver of price momentum the former should be robust when controlling for the latter. Hence, we determine the earnings momentum alphas arising from the following four-factor model

$$R_{Lt} - R_{St} = \alpha + \beta(R_{Mt} - R_{Ft}) + \gamma R_{SMBt} + \delta R_{HMLt} + \eta R_{WMLt} + \varepsilon_t, \tag{5}$$

where the original Fama-French model is augmented by the return to the price momentum strategy, R_{WMLt} (winner minus loser). In Table X we contrast the Fama-French results to those of the above four-factor model for all countries' respective hedge strategies. As before, results for the quintile portfolios according to the U.S. and the European aggregate strategy are also depicted. Again, we note that the additional factor leads to a considerable increase in statistical fit. In fact, the adjusted R^2 of the Fama-French model and the four-factor model almost resemble the figures

obtained in the price momentum case. Consistent with Chordia and Shivakumar (2006), the U.S. earnings momentum alpha remains large at 72 basis points with a highly significant t-statistic of 5.14. Given that the European earnings momentum alpha has a t-statistic of 6.76, we suspect that this observation carries over to other countries. Indeed, 13 of 15 original European anomalies remain significant after controlling for price momentum; only Italy and Norway do cease to have significant earnings momentum alphas.

To summarize, among 17 countries we initially find 15 countries exhibiting significant price momentum alphas in a classical Fama-French setting. Among these 15 countries, seven countries follow the explanation offered by Chordia and Shivakumar (2006), i.e., earnings momentum subsumes price momentum. These countries include Germany, Switzerland, France, Spain, Portugal, the Netherlands, and Finland. Among the eight remaining four-factor price momentum anomalies, five countries also have four-factor earnings momentum anomalies (the U.S., the U.K., Belgium, Sweden, and Denmark). Two countries' earnings momentum alphas cease to be significant (Italy and Norway) and Greece exhibits no earnings momentum at all. In summary, we obtain an aggregate European pattern that suggests a translation of Chordia and Shivakumar (2006)'s argument to European equity markets. Thus, it is all the more surprising why we are refuting their rationale for the U.S..

To uncover whether this reasoning may be confined to special circumstances, we investigate the time series of price momentum alphas arising from a trailing regression. First, we consider price momentum and contrast the respective Fama-French alpha (dashed line) and the four-factor alpha (solid line) in the upper graphs of Figure 3. For the U.S., we see that the large Fama-French alpha is substantially reduced when additionally controlling for earnings momentum. However, by the end of 1999, which coincides with the end of the sample period in Chordia and Shivakumar (2006), this relation breaks down for some years. Obviously, price and earnings momentum have decoupled following the burst of the tech bubble. This reasoning supports the general view that price momentum typically will be a result of investors' underreaction to fundamental news, while the market frenzy at the end of the nineties is more likely the result from overreaction. This observation suggests that U.S. investors will most likely have put less weight on earnings information following several accounting scandals at the beginning of the century. On the other hand, the European Fama-French price momentum alpha is literally neutralized by the earnings

momentum factor for the whole sample period. Hence, while earnings momentum is a crucial driver of price momentum there seem to be other forces at work, too.

[Figure 3 about here.]

VI. Origins of Momentum: Risk or Behavioral Bias?

The results of the previous section essentially suggest that any momentum rationale will be closely linked to the drivers of earnings momentum. In further rationalizing the momentum anomaly, we consider the following ideas. First, we mimic Chordia and Shivakumar (2006) in examining the link between momentum and the macroeconomy. Second, we will analyze the interaction of momentum with measures of information uncertainty. Third, we will investigate the role of liquidity risk in momentum profits.

A. Momentum and the Macroeconomy

It may well be that momentum is closely related to the macroeconomy since momentum may simply reflect future macroeconomic activity or the mispricing of certain macroeconomic variables. To test respective relation, we follow Liew and Vassalou (2000) and Chordia and Shivakumar (2006) in regressing future GDP growth on lagged values of the Fama-French factors and one of the two momentum factors.

Table XI gives the results of a regression of 12-month ahead growth in real GDP on 12-month compounded momentum, either price momentum WML or earnings momentum PMN, and Fama-French factors MKT, SMB, and HML. GDP growth is measured as the change in the log of GDP. Given that GDP is available on a quarterly basis, the regressions are also on a quarterly basis. Since the regressions rely on overlapping data, the reported t-statistics are based on Newey-West standard errors, see Newey and West (1987). The sample period is from July 1987 to June 2007.

The following results can be inferred from Table XI. First, we recover the market factor—if significant— to be a leading indicator of future economic growth in some of the countries, i.e., both are positively related as indicated by the positive coefficient estimates. Second, while Liew

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and Vassalou (2000) report SMB and HML to also be positively related to future GDP growth in major equity markets until the middle of the nineties, we find a negative relation in many countries. That is, small cap or value stocks suffer prior to periods of economic growth, whereas they thrive before an economic slowdown. Third, the link between earnings momentum and macroeconomy appears to be strongest in the U.S. and the European aggregate. Given a positive relation instead of a negative one suggests that earnings momentum is a proxy for a macroeconomic risk factor. However, besides the U.S. and the Europe aggregate, we can only obtain two further countries in which earnings momentum significantly predicts GDP growth: Portugal and Belgium exhibit a positive relation. Hence, there appears to be no definite pattern in linking earnings momentum to the macroeconomy, an observation that carries over to the regression results obtained using the price momentum factor.

While our findings sharply contrast with the U.S. result of Chordia and Shivakumar (2006), who detect a negative relation but for a different time period, it is by and large affirmative of the international study of Liew and Vassalou (2000). They fail to find a link between WML and GDP growth. Given the strong link between price and earnings momentum documented in this paper, we are thus bound to uncover a similar result for PMN. Also, using alternative measures of the macroeconomy like industrial production growth or consumption growth reveals (unreported) results that are qualitatively similar to the ones for GDP growth.

Furthermore, our evidence aligns with the study of Griffin, Ji, and Martin (2003) who also fail to establish a link between price momentum and macroeconomic risk factors in many countries. However, one may argue that momentum may be more of a common factor phenomenon when focussing on bigger companies. For instance, Scowcroft and Sefton (2005) argue that the finding of industry momentum driving price momentum is confined to large cap universes. Since we are dealing with a very comprehensive sample we may thus be prone to refute any common factor effects in momentum. However, Kang and Li (2005) show that traditional approaches of separating common from stock-specific factors are flawed in that they have a stock-specific component implicit in the common factor component. This problem is remedied within their model and their empirical results suggest that the stock-specific component is probably the only source of U.S. momentum profits. To conclude, failing to find a definite relation between momentum and the macroeconomy

may suggest that momentum is rather due to a behavioral bias, an idea we will explore in the following.

B. Momentum and Information Uncertainty

In this section, we will analyze the interaction of momentum and information uncertainty. The theoretical model of Hong and Stein (1999) posits that firm-specific information only gradually spreads across investors resulting in underreaction and, as a consequence, short-term return continuation. If momentum is due to investors' underreaction to fundamental news, the respective price drift should be higher in more opaque information environments for which information diffusion is slowest. In fact, Hong, Lim, and Stein (2000) find empirical support for their theory by demonstrating that U.S. momentum strategies are more effective in companies of small size or in companies with low analyst coverage. Besides these two metrics, Zhang (2006) recently provides evidence that the U.S. price momentum strategy is also more effective when limited to high uncertainty stocks as measured by firm age, dispersion in analysts' earnings forecasts, stock volatility, and cash flow volatility. Especially, the dispersion in analysts' earnings forecasts has been used in prior studies to proxy for differences in opinion, see Diether, Malloy, and Scherbina (2002). For instance, this heterogeneity in beliefs is a necessary condition for price drift in the model of Banerjee, Kaniel, and Kremer (2008), a link that is empirically corroborated for the U.S. by Verardo (2008).

Of course, establishing a link between international momentum and information uncertainty would further substantiate the momentum rationale of investors underreacting to fundamental news. Hence, we will examine price and earnings momentum profits for different degrees of information uncertainty. We consider four measures to monthly proxy for information uncertainty: Analyst coverage, size, total stock volatility, and idiosyncratic volatility. Total stock volatility is estimated using the last three year's monthly stock returns, and idiosyncratic volatility arises from a standard Fama-French regression that also uses the last three year's monthly stock returns.

Table XII gives the results for the price momentum strategy in the upper panel A. In particular, we first sort stocks into five quintiles based on past returns. For each quintile the stocks are further sorted into three terciles based on one of the four information uncertainty proxies. Obviously,

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this procedure requires a sufficient number of companies in a given country to deliver meaningful results and we therefore exclude the seven smallest countries from the analysis, i.e., Austria, Belgium, Finland, Greece, Ireland, Norway, and Portugal.

Our findings are as follows. First, we confirm the empirical evidence for the U.S.: Price momentum is indeed more pronounced for stocks with low analyst coverage, smaller size or higher volatility, be it total or idiosyncratic volatility. Second, the latter findings do not only translate to the European momentum strategy, but also to most of the European country strategies. In fact, only Denmark does refute the underreaction rationale. Third, while the earnings momentum results are quite similar among the major equity markets, we note that the results for some smaller countries are somewhat muted.

Thus, having gathered substantial support for the underreaction theory, one may wonder as to why the momentum anomaly is not arbitraged away. For the U.S., recent research contends that high arbitrage costs prevent rational investors from exploiting the momentum anomaly, see Arena, Haggard, and Yan (2008) for price momentum and Mendenhall (2004) for post-earnings announcement drift. Presumably, the cost of short-selling small stocks is not offset by the expected momentum profits. In fact, a stock's idiosyncratic volatility is a common proxy for arbitrage costs. The fact that we find momentum to be most pronounced in stocks with high idiosyncratic volatility additionally provides a persuasive explanation for the persistence of the momentum effect.

C. Momentum and Liquidity

In further elaborating on the above argument we next examine the role of liquidity when implementing momentum strategies. Lesmond, Schill, and Zhou (2004) and Korajczyk and Sadka (2004) evidence that exploiting U.S. price momentum is costly, in fact, trading costs appear to erode all of the potential profits rendering the momentum arbitrage opportunity an illusion. The trading costs basically derive from frequent trading in mostly illiquid stocks. Consequently, Sadka (2006) documents a close relation between liquidity risk and U.S. momentum strategies. Moreover, Liu (2006)'s liquidity-augmented two-factor asset pricing model almost completely subsumes the U.S. price momentum alpha. Hence, we expect liquidity to also play a crucial role in inhibiting profitable execution of the European momentum strategies.

To operationalize this conjecture we will analyze the profitability of the momentum strategies when restricting to winner and loser stocks characterized by different degrees of liquidity. Liu (2006) aptly describes liquidity "as the ability to trade large quantities *quickly* at low cost with little price impact". To account for the according distinct dimensions of liquidity we compute different metrics. A stock's dollar volume or its turnover allow to capture the trading quantity dimension. As for the price impact dimension we resort to the *ILLIQ* measure of Amihud (2002) which is the absolute daily return over the associated dollar volume. To obtain an aggregate monthly value of *ILLIQ* we simply compute its mean over the corresponding daily values. The fourth measure is the one introduced by Liu (2006) which has been designed to capture multiple dimensions of liquidity, such as trading speed and trading quantity. Its definition is as follows:

$$\text{Liu Measure} = \text{Number of No-Trading Days over the prior 12 months} + \frac{1/\text{Turnover}}{1,000,000} \qquad (6)$$

where turnover is the average daily turnover over the prior 12 months. This measure addresses the trading speed dimension of liquidity since it very well captures lock-in-risk, i.e., the danger of being locked in a certain position that cannot be sold.[4]

Table XIII displays the profitability of momentum strategies restricted to winner and loser stocks characterized by different degrees of liquidity. In particular, we first sort stocks into five quintiles based on past returns or earnings revisions. For each quintile the stocks are further sorted into three terciles based on one of the four liquidity measures. Again, we exclude the seven smallest countries from the analysis, i.e., Austria, Belgium, Finland, Greece, Ireland, Norway, and Portugal. Panel A of Table XIII gives the results for the price momentum strategy. Across most countries and liquidity metrics the general pattern is that the least momentum profits occur for the most liquid stocks and that profitability is increasing with illiquidty. For instance, U.S. price momentum for stocks with the lowest *ILLIQ* values is only significant at the 10%-level and price momentum for high volume stocks is also significantly smaller than the result obtaining for the whole sample.

However, this pattern of momentum profitability decreasing with liquidity is less pronounced for the aggregate European strategy. The according hedge returns still amount to at least 120

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[4]Note that while the first three measures only take into account the stocks' liquidity over the precedent month the Liu measure hinges on data of the preceding year.

basis points per month with t-statistics well above 4—suggesting that momentum may be less costly to implement in Europe than in the U.S.. This observation especially seems to derive from the U.K., Germany and Switzerland in which price momentum is rather strong among more liquid securities. On the other hand, France, Spain and the Netherlands do not exhibit sustainable momentum in the most liquid securities. However, Italy, Sweden and Denmark even reverse the expected outcome by exhibiting no momentum in the least liquid securities.

Interestingly, when using the metric share turnover the direction of the liquidity-momentum profitability relationship is sometimes reversed. For instance, judging by share turnover both the U.S. and European aggregate price momentum strategy are most profitable in the most liquid securities. This puzzling result is in line with Hou, Peng, and Xiong (2006) who argue that trading volume as measured by turnover is a proxy for investor attention. When price momentum is mainly an overreaction-driven phenomenon it should be relatively stronger among high turnover stocks. Vice versa, earnings momentum that is likely to be more related to underreaction should be relatively stronger among low turnover stocks since investor attention is presumably lower. Considering Panel B of Table XIII we do in fact recover this result for U.S. earnings momentum— regardless of the liquidity measure. The finding is most pronounced for the *ILLIQ* measure for which we obtain an insignificant monthly return spread of 23 basis points. This result complements the findings of Chordia, Goyal, Sadka, Sadka, and Shivakumar (2007) who show the post-earnings announcement drift to be equally useless among illiquid stocks as measured by *ILLIQ*.

For Europe, the results for the aggregate earnings momentum are quite different; in fact, across all liquidity measures the strategy earns at least 74 basis points with t-statistics in excess of 5. However, the country-level results are more in line with the persuasive U.S. story. For example, Germany, France, the Netherlands, Sweden and Denmark exhibit considerably less earnings momentum for highly liquid stocks. All in all, our results suggest that liquidity appears to be a more severe impediment to implementing earnings momentum strategies as opposed to price momentum strategies. Corroborating the rationale of Hou, Peng, and Xiong (2006) we also find the highest U.S. price momentum among high turnover stocks, however, all of the remaining liquidity measures do not support this finding. Still, we think that overreaction may play a role in driving the differences between the price and earnings momentum findings.

VII. Conclusion

The investigation of a given security mispricing typically addresses two questions: Is the anomaly simply a compensation for risk or is the anomaly real and, if yes, what behavioral bias is driving it? Of course, these questions are only meaningful if the security mispricing is not spurious in the first place. Hence, one needs to safeguard against data snooping biases. We find that both price and earnings momentum are robust with respect to multiple testing issues, reinforcing the growing body of research documenting magnitude and persistence of both anomalies. Researchers have long been speculating about a link between price and earnings momentum. Inspired by the work of Chordia and Shivakumar (2006), we find that European price momentum most likely is subsumed by earnings momentum. However, there are some European countries that do not support such a conclusion. As for the U.S., we especially observe some decoupling of price and earnings momentum following the burst of the tech bubble. In any case, our findings suggest that the price momentum rationale will most likely be related to earnings momentum. Given that momentum does not appear to proxy for macroeconomic risk, we narrow the search in favor of a behavioral-based explanation of the momentum anomaly. In particular, winner and loser portfolios characterized by high information uncertainty give rise to even larger momentum profits. Thus, given that price momentum largely is earnings momentum in disguise, our evidence supports the rationale of momentum being driven by investors' underreaction to fundamental news. Moreover, we attribute the persistence of the momentum anomaly to the fact that significant arbitrage costs prevent investors from its exploitation. Also, liquidity is a crucial driver in governing the momentum effects. However, while the U.S. momentum effects clearly are most pronounced among illiquid winner and loser stocks, there are some European markets that exhibit very profitable momentum strategies even for highly liquid stocks. Especially, the momentum strategies designed for the aggregate European sample appear quite robust.

Appendix A: Multiple Testing based on the StepM Method

We describe the k-StepM that allows for controlling the k-FWE. Consider S individual decision problems of the form

$$H_s : \theta_s \leq 0 \text{ versus } H_s' : \theta_s > 0, \quad 1 \leq s \leq S, \tag{7}$$

each referring to the hedge strategy in country s. We define the parameter θ_s in such a way that under the null hypothesis H_s, strategy s does not beat the zero benchmark. Given the time series of the hedge strategies, we can compute the test statistic $w_{T,s}$ with an estimate of its standard deviation $\sigma_{T,s}$ based on the returns and the strategies' alphas according to the Fama-French momentum regressions. In particular, using monthly hedge returns $x_{t,s}$, we compute average monthly buy-and-hold returns as in Section III. Thus, we have

$$w_{T,s} = \bar{x}_{T,s} = \frac{1}{T} \sum_{t=1}^{T} x_{t,s}, \tag{8}$$

which we studentize by $\sigma_{T,s}$ that we estimate using the Parzen kernel. Likewise, the test statistic for the alpha is the intercept from estimating equation (3)

$$w_{T,s} = \hat{\alpha}_{T,s}, \tag{9}$$

studentized by the estimated standard deviation of $\hat{\alpha}_{T,s}$.

Within the k-StepM method, we first re-label strategies such that r_1 corresponds to the largest test statistic and r_S to the smallest one. Then, we need to determine a confidence region of the form

$$[w_{T,r_1} - \sigma_{T,r_1} d_1, \infty) \times \cdots \times [w_{T,r_S} - \sigma_{T,r_S} d_1, \infty). \tag{10}$$

Whenever $0 \notin [w_{T,r_s} - \sigma_{T,r_s} d_1, \infty)$, we reject H_s for $s = 1, ..., S$. To control the FWE, d_1 ideally is given by the $(1 - \alpha)$-quantile of the distribution of the largest 'centered' studentized[5] statistic

$$\frac{w_{T,s} - \theta_s}{\sigma_{T,s}}$$

among all true hypotheses. However, we do not know which hypotheses are true and we do not know the true probability mechanism P. Therefore, we take the largest difference among all hypotheses and we replace P by a bootstrap estimate $\hat{P}$, which implies that the StepM method will only allow for asymptotic control of the FWE. This feature is shared by all other commonly used multiple testing procedures.

If we suppose that we have rejected $R_1 < k$ hypotheses, we can construct a new confidence region to reexamine the remaining $(S - R_1)$ smallest test statistics

$$[w_{T,R_1+1} - \sigma_{T,R_1+1} d_2, \infty) \times \cdots \times [w_{T,r_S} - \sigma_{T,r_S} d_2, \infty), \tag{11}$$

which is a smaller confidence region, because it typically holds that $d_1 > d_2 > \cdots > d_S$. Hence, we can reject more false hypotheses. Therefore, such a stepwise procedure is more powerful than the single-step method. For the computation of d_2, we again lack both P and the set of true hypotheses. For P, we use the bootstrap estimate $\hat{P}$. However, we now only maximize over the set of hypotheses that have not been rejected yet. Since this is a smaller set, $S - R_1$ versus S elements, d_2 will typically be smaller than d_1 (and at most equally large). If no additional rejection occurs, we stop. Otherwise, we proceed in the same fashion until there are no further rejections.

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[5]Studentization requires that the average return be divided by its standard error. To obtain valid confidence intervals for the expected return, we must multiply these quantiles with the country's return standard error. Romano and Wolf (2005) advocate the use of studentization, since it is more powerful and gives more appropriate coverage probabilities for individual θ_{r_s}, especially when test statistics show different standard deviations. Clearly, the latter applies to our case.

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Table I
Country Overview

The table contains descriptive information on the companies that have been domestically traded in the sample period (1987-2007). For further reference we may use abbreviated country codes (Abbr.). The screening of country lists depicts the evolution of the countries' samples. First, we give the *total* size of the country lists followed by the number of companies surviving the first screen for *Major* listings. The column headed *Region* contains the number of companies surviving the screen eliminating regional listings and the like. The *Final* screen excludes companies which exhibit free-floating market value below 10 million USD. We further describe this final sample giving the number of a country's dead companies (#Dead) and the number of companies with at least one I/B/E/S estimate in the sample period (#I/B/E/S), along with respective percentage values (%-Dead and %-I/B/E/S). The last column gives the earliest month with sufficient Fama-French data. The table provides information for the U.S. in Panel A, while Panel B covers European countries.

| Country | Abbr. | Region | Screening of Country Lists | | | | Sample: FMV> 10 | | | | | | Date |
			Total	*Major*	*Region*	FMV> 10	#Dead	%Dead	#Return	%Return	#I/B/E/S	%I/B/E/S	FF
Panel A: USA													
USA	USA	America	36659	20030	7279	6272	2554	40.7%	6180	98.5%	4860	77.5%	Jul 92
Panel B: Europe													
Europe		Europe	29266	10522	9383	7019	1996	28.4%	6901	98.3%	5169	73.6%	
United Kingdom	UK	Europe	7677	3444	3232	2268	732	32.3%	2232	98.4%	1652	72.8%	Jul 87
Ireland	IRL	Europe	187	98	94	85	26	30.6%	83	97.6%	63	74.1%	Feb 91
Germany	GER	Europe	10740	1833	1525	1017	228	22.4%	991	97.4%	646	63.5%	Jan 88
Austria	A	Europe	360	177	161	119	31	26.1%	115	96.6%	80	67.2%	Jan 90
Switzerland	CH	Europe	1130	387	316	277	49	17.7%	274	98.9%	217	78.3%	Jan 90
France	FR	Europe	2643	1458	1368	945	258	27.3%	917	97.0%	631	66.8%	Jan 90
Italy	IL	Europe	794	390	365	345	95	27.5%	345	100 %	305	88.4%	Jan 90
Greece	GR	Europe	523	393	360	338	57	16.9%	338	100 %	234	69.2%	Jun 98
Spain	ES	Europe	311	204	180	170	51	30.0%	168	98.8%	160	94.1%	Feb 92
Portugal	POR	Europe	296	146	134	92	48	52.2%	91	98.9%	66	71.7%	Jun 97
Netherlands	NL	Europe	791	272	250	201	77	38.3%	199	99.0%	182	90.5%	Jan 90
Belgium	BEL	Europe	1000	288	263	206	40	19.4%	200	97.1%	129	62.6%	Jan 90
Sweden	SWE	Europe	1203	549	441	346	109	31.5%	344	99.4%	280	80.9%	Jan 90
Norway	NOR	Europe	585	328	284	254	98	38.6%	252	99.2%	219	86.2%	Jan 90
Denmark	DK	Europe	685	365	230	197	55	27.9%	197	100 %	167	84.8%	Jan 90
Finland	FN	Europe	341	190	180	159	42	26.4%	155	97.5%	138	86.8%	Mar 91
		All	65925	30552	16662	13291	4550	34.2%	13081	98.4%	10029	75.5%	
		Top 5	58922	27314	13845	10848	3881	35.8%	10664	98.3%	8094	74.6%	

Table II
Country Universes by Year

The table gives the average number of companies which are considered for the momentum strategies. Panel A covers the U.S. and Panel B covers European countries.

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Σ #
Panel A: USA																					
USA	827	859	928	925	993	1104	1242	1366	1568	1804	2038	2172	2336	2260	2041	1827	2068	2117	2183	2247	32905
Panel B: European Countries																					
Europe	556	638	775	846	891	1038	1141	1204	1336	1521	1641	1761	1905	1845	1611	1358	1459	1570	1628	1885	26609
UK	144	128	110	118	129	141	169	167	197	234	264	256	300	268	207	171	227	282	310	366	4188
Ireland	3	5	4	2	3	2	3	5	10	13	16	16	15	15	12	13	16	17	17	20	207
Germany	93	92	105	110	120	188	242	224	213	230	252	264	257	262	237	175	185	202	206	250	3907
Austria	16	18	19	22	25	27	30	32	37	42	38	36	37	30	31	25	27	25	24	30	571
Switzerland	73	84	94	99	100	104	106	106	107	113	121	131	134	142	148	139	128	126	122	150	2327
France	62	82	116	131	133	156	154	165	191	220	256	277	310	327	298	264	261	265	276	311	4255
Italy	13	26	28	31	29	28	27	29	33	39	50	67	67	67	78	70	74	87	97	112	1052
Greece	0	0	0	0	0	0	15	59	79	75	70	82	109	61	50	38	48	43	45	56	830
Spain	13	23	54	69	68	64	62	67	68	69	74	90	90	91	86	79	82	83	81	83	1396
Portugal	0	0	0	0	8	24	26	28	31	36	37	40	42	29	15	10	7	10	12	18	373
Netherlands	54	79	86	91	91	93	95	98	103	110	113	120	132	127	106	86	92	91	88	91	1946
Belgium	30	29	29	31	34	38	39	41	44	45	51	63	66	73	76	64	65	74	68	74	1034
Sweden	19	16	29	31	33	34	48	58	73	101	108	125	131	127	90	71	85	89	92	106	1466
Norway	8	11	12	15	17	17	19	21	27	50	49	51	59	68	51	35	45	54	59	78	746
Denmark	23	37	70	72	77	96	75	67	74	89	89	82	86	88	66	57	54	61	70	68	1401
Finland	0	3	14	18	18	21	25	30	42	49	50	55	64	64	52	54	56	55	54	66	790
Σ	1378	1492	1698	1765	1878	2137	2377	2563	2897	3319	3676	3927	4235	4099	3644	3178	3520	3681	3804	4126	59394

Table III
Descriptive Statistics of Momentum Quintile Portfolios 1/2

The table gives average monthly buy-and-hold returns and volatility of quintile portfolios that are built monthly dependent on the price momentum ranking (left panel) or dependent on the earnings momentum ranking (right panel). All figures refer to the period from July 1987 to June 2007. We give the return differential of the respective hedge strategies along with the according t-statistic in parentheses. The table also gives the two risk proxies beta and size. Both are gathered using data of the whole period, in particular beta arises from a standard CAPM regression and size is measured as the average of log(marketvalue). Note that we do not compute the size proxy for the hedge strategies but give the t-statistic belonging to the return differential.

Country		*Price Momentum Ranking* Lowest	2	3	4	Highest	*Hedge Strategies* Price	Earnings	*Earnings Momentum Ranking* Lowest	2	3	4	Highest		Country
USA	Return	0.93	1.15	1.21	1.27	1.72	0.79	0.58	1.27	1.16	1.10	1.43	1.85	Return	USA
	Volatility	6.48	4.41	3.98	4.17	5.98	4.40	2.17	5.50	4.40	3.82	4.21	4.91	Volatility	
	Beta	1.20	0.82	0.72	0.76	1.07	-0.14	-0.04	1.15	0.90	0.74	0.81	0.99	Beta	
	Size	19.77	20.29	20.46	20.49	20.21	(2.80)	(4.11)	19.47	20.17	20.61	20.60	20.04	Size	
Europe	Return	0.56	0.88	1.10	1.25	1.75	1.19	0.83	0.91	0.98	1.06	1.28	1.74	Return	Europe
	Volatility	5.76	4.24	3.93	4.02	4.77	3.69	1.71	4.82	4.28	3.82	3.74	3.99	Volatility	
	Beta	1.24	0.94	0.87	0.89	1.03	-0.21	-0.14	1.18	1.05	0.92	0.89	0.96	Beta	
	Size	20.32	20.92	21.16	21.29	21.15	(5.00)	(7.52)	19.96	21.02	21.43	21.43	20.63	Size	
UK	Return	0.54	0.96	1.09	1.19	1.42	0.88	0.78	0.89	0.88	1.22	1.27	1.67	Return	UK
	Volatility	5.28	4.32	4.18	4.30	4.92	3.70	2.10	4.42	4.14	3.99	3.88	4.01	Volatility	
	Beta	0.90	0.75	0.73	0.76	0.84	-0.06	-0.07	0.85	0.78	0.74	0.71	0.74	Beta	
	Size	24.75	24.94	24.95	24.84	24.57	(3.68)	(5.73)	24.54	24.91	25.11	24.89	24.46	Size	
Ireland	Return	1.73	1.43	1.78	0.98	1.84	0.39	1.23	1.12	1.73	1.49	1.71	2.49	Return	Ireland
	Volatility	6.91	5.72	5.62	6.20	6.23	5.74	5.67	6.59	4.99	4.97	5.38	5.60	Volatility	
	Beta	0.81	0.72	0.83	0.88	0.73	0.01	-0.15	0.87	0.67	0.68	0.81	0.74	Beta	
	Size	20.05	20.24	20.40	20.21	20.09	(1.04)	(3.36)	19.50	20.61	21.00	20.89	19.87	Size	
Germany	Return	0.22	0.66	0.80	0.99	1.25	1.03	0.76	0.49	0.62	0.73	0.84	1.24	Return	Germany
	Volatility	7.47	5.34	4.53	4.41	4.57	5.25	2.30	5.49	5.23	4.90	4.68	4.91	Volatility	
	Beta	1.51	1.11	0.92	0.88	0.90	-0.60	-0.02	1.20	1.15	1.06	1.02	1.08	Beta	
	Size	19.51	19.95	20.13	20.21	20.13	(3.04)	(5.10)	19.36	20.07	20.41	20.18	19.92	Size	
Austria	Return	1.17	1.21	1.24	1.46	1.50	0.33	0.58	1.17	1.33	1.06	1.11	1.76	Return	Austria
	Volatility	6.23	5.43	5.09	5.60	5.90	4.87	4.47	6.75	5.71	5.13	4.82	5.48	Volatility	
	Beta	1.15	1.12	1.07	1.11	1.18	0.03	-0.09	1.38	1.19	1.04	0.96	1.07	Beta	
	Size	19.00	19.39	19.60	19.70	19.65	(1.04)	(2.02)	19.06	19.45	19.64	19.61	19.59	Size	
Switzerland	Return	0.62	0.82	0.90	1.06	1.41	0.79	0.60	0.84	0.95	0.96	1.21	1.44	Return	Switzerland
	Volatility	6.35	4.99	4.60	4.81	5.40	4.16	3.02	5.83	4.87	4.26	4.37	4.69	Volatility	
	Beta	1.29	1.06	0.98	1.02	1.11	-0.18	-0.16	1.34	1.13	0.98	1.00	1.07	Beta	
	Size	19.90	20.24	20.36	20.49	20.39	(2.94)	(3.07)	19.67	20.36	20.55	20.50	20.20	Size	
France	Return	0.82	1.06	1.17	1.34	1.73	0.92	0.77	1.08	1.14	1.31	1.40	1.85	Return	France
	Volatility	7.37	5.61	5.04	5.16	5.74	4.66	2.81	6.38	5.64	5.16	5.00	5.21	Volatility	
	Beta	1.36	1.06	0.95	1.00	1.09	-0.27	-0.15	1.29	1.15	1.04	0.99	1.07	Beta	
	Size	19.52	20.14	20.31	20.31	20.13	(3.04)	(4.24)	19.21	20.07	20.33	20.35	19.90	Size	
Italy	Return	0.36	0.76	0.76	0.89	1.49	1.12	0.36	0.82	0.83	0.88	1.06	1.19	Return	Italy
	Volatility	7.71	6.53	6.18	5.73	6.41	5.16	3.22	6.61	6.54	6.62	6.13	5.93	Volatility	
	Beta	1.16	1.02	0.97	0.88	0.94	-0.22	-0.11	1.03	1.04	1.02	0.92	0.93	Beta	
	Size	20.28	20.56	20.66	20.61	20.45	(3.37)	(1.74)	19.87	20.69	20.78	20.69	20.19	Size	

Table IV
Descriptive Statistics of Momentum Quintile Portfolios 2/2

The table gives average monthly buy-and-hold returns and volatility of quintile portfolios that are built monthly dependent on the price momentum ranking (left panel) or dependent on the earnings momentum ranking (right panel). All figures refer to the period from July 1987 to June 2007. We give the return differential of the respective hedge strategies along with the according t-statistic in parentheses. The table also gives the two risk proxies beta and size. Both are gathered using data of the whole period, in particular beta arises from a standard CAPM regression and size is measured as the average of log(marketvalue). Note that we do not compute the size proxy for the hedge strategies but give the t-statistic belonging to the return differential.

Country		Price Momentum Ranking					Hedge Strategies		Earnings Momentum Ranking						Country
		Lowest	2	3	4	Highest	Price	Earnings	Lowest	2	3	4	Highest		
Greece	Return	0.75	1.40	1.53	2.21	2.91	2.16	0.33	1.69	1.23	1.99	1.57	1.93	Return	Greece
	Volatility	10.33	9.75	9.63	9.94	11.01	6.07	4.30	10.67	9.47	10.39	9.54	9.79	Volatility	
	Beta	0.81	0.78	0.78	0.77	0.83	0.02	0.01	0.84	0.75	0.82	0.76	0.77	Beta	
	Size	19.07	19.39	19.51	19.69	19.51	(5.53)	(1.17)	19.15	19.33	19.52	19.61	19.26	Size	
Spain	Return	1.08	1.15	1.32	1.43	1.54	0.46	0.85	0.88	0.84	1.21	1.35	1.84	Return	Spain
	Volatility	7.38	5.39	5.21	5.31	5.47	5.00	4.41	6.87	5.49	5.16	5.04	5.97	Volatility	
	Beta	1.14	0.90	0.86	0.85	0.86	-0.27	-0.16	1.13	0.92	0.85	0.83	0.91	Beta	
	Size	19.91	20.26	20.43	20.51	20.34	(1.42)	(2.98)	19.48	20.35	20.56	20.74	20.17	Size	
Portugal	Return	1.10	1.57	1.51	1.54	1.83	0.70	0.88	0.87	1.29	1.32	1.50	1.75	Return	Portugal
	Volatility	6.60	6.11	6.00	5.26	6.24	5.51	5.26	6.56	5.85	5.55	5.35	6.58	Volatility	
	Beta	0.91	0.84	0.81	0.71	0.77	-0.15	-0.06	0.93	0.79	0.77	0.71	0.81	Beta	
	Size	19.34	19.85	20.03	19.88	19.82	(1.97)	(2.59)	19.34	20.01	19.89	19.86	19.59	Size	
Netherlands	Return	0.84	1.18	1.31	1.35	1.72	0.87	0.85	1.11	1.16	1.20	1.58	1.96	Return	Netherlands
	Volatility	6.45	5.01	4.69	4.64	5.47	4.40	3.57	5.91	4.80	4.41	4.44	4.79	Volatility	
	Beta	1.22	0.98	0.91	0.89	1.00	-0.21	-0.17	1.19	0.97	0.90	0.87	0.95	Beta	
	Size	19.29	19.63	19.72	19.73	19.68	(3.08)	(3.69)	18.86	19.71	20.16	19.93	19.30	Size	
Belgium	Return	0.60	0.72	1.00	1.26	1.62	1.02	0.75	0.89	0.92	1.06	1.31	1.63	Return	Belgium
	Volatility	5.65	4.84	4.69	4.86	5.17	4.22	3.07	5.27	4.73	4.28	4.35	4.73	Volatility	
	Beta	1.28	1.15	1.14	1.17	1.17	-0.11	-0.02	1.30	1.21	1.10	1.09	1.20	Beta	
	Size	19.58	20.03	20.16	20.27	20.09	(3.73)	(3.77)	19.32	20.11	20.32	20.33	19.84	Size	
Sweden	Return	1.03	1.34	1.38	1.56	2.09	1.05	0.77	1.07	1.34	1.53	1.75	1.84	Return	Sweden
	Volatility	7.64	6.02	5.69	6.07	6.69	4.82	4.07	6.81	6.19	5.94	5.64	5.79	Volatility	
	Beta	0.91	0.72	0.67	0.71	0.76	-0.15	-0.13	0.82	0.75	0.71	0.65	0.67	Beta	
	Size	21.79	22.04	22.10	22.22	22.18	(3.38)	(2.95)	21.40	22.05	22.23	22.20	21.87	Size	
Norway	Return	1.25	1.40	1.42	1.18	1.81	0.75	0.43	1.46	1.22	1.02	1.55	1.85	Return	Norway
	Volatility	8.07	6.24	6.30	6.45	7.44	5.98	4.98	7.65	6.48	6.36	6.25	6.26	Volatility	
	Beta	1.05	0.81	0.81	0.83	0.94	-0.15	-0.15	1.01	0.87	0.83	0.79	0.79	Beta	
	Size	21.44	21.70	21.80	21.82	21.81	(1.94)	(1.35)	21.55	21.54	21.60	21.69	21.74	Size	
Denmark	Return	0.81	1.11	1.06	1.55	2.04	1.22	1.16	0.97	1.02	1.32	1.39	2.13	Return	Denmark
	Volatility	6.02	4.29	4.07	4.32	4.98	4.54	4.22	5.14	4.44	4.32	4.19	5.05	Volatility	
	Beta	1.35	1.08	1.05	1.05	1.15	-0.19	-0.03	1.29	1.13	1.07	1.03	1.16	Beta	
	Size	20.75	21.06	21.15	21.19	21.26	(4.18)	(4.27)	20.48	21.05	21.24	21.32	20.95	Size	
Finland	Return	0.92	1.33	1.54	1.54	1.93	1.01	1.18	1.01	1.08	1.21	1.44	2.19	Return	Finland
	Volatility	8.06	6.34	6.46	5.86	6.59	5.60	4.84	7.70	6.99	6.37	5.35	6.39	Volatility	
	Beta	1.08	0.86	0.89	0.80	0.85	-0.22	-0.11	1.05	0.99	0.88	0.75	0.83	Beta	
	Size	19.38	19.62	19.60	19.66	19.82	(2.79)	(3.78)	19.27	19.61	19.67	19.74	19.52	Size	

Table V
Table V
Time-Series-Regressions of Price Momentum Portfolios

The Table gives the results of a regression according to Equation (**??**) using 240 monthly returns ranging from July 1987 to June 2007 along with the according t-statistics. Portfolio 1 refers to the loser quintile, portfolio 5 refers to the winner quintile, and portfolio 5-1 is the long-short portfolio (winner-loser).

		Fama-French Model								
		α	β	γ	δ	$t(\alpha)$	$t(\beta)$	$t(\gamma)$	$t(\delta)$	Adj. R^2
	1	-0.90	1.00	0.34	0.08	-5.29	19.38	5.43	1.28	84.5
USA	5	0.11	0.82	0.34	-0.30	0.63	15.64	5.45	-5.06	81.0
	5-1	1.01	-0.18	0.01	-0.38	3.57	-2.07	0.08	-3.88	7.0
	1	-0.41	0.76	0.41	0.21	-2.54	8.23	5.55	2.76	84.6
Europe	5	1.05	0.52	0.45	-0.20	7.82	6.80	7.32	-3.19	84.7
	5-1	1.46	-0.24	0.04	-0.41	5.84	-1.68	0.33	-3.49	9.4
	1	-0.18	-0.33	1.19	0.04	-1.24	-3.05	11.77	0.64	82.0
UK	5	0.72	0.28	0.57	-0.29	4.67	2.41	5.28	-4.67	76.4
	5-1	0.90	0.60	-0.62	-0.32	4.02	3.65	-3.99	-3.64	12.0
	1	0.11	0.64	0.25	-0.02	0.29	6.81	2.53	-0.39	42.3
Ireland	5	0.35	0.65	0.17	-0.17	1.19	10.74	2.37	-3.58	54.6
	5-1	0.40	0.22	-0.27	-0.15	1.00	2.17	-2.51	-2.34	4.5
	1	-0.95	1.37	0.15	-0.06	-3.83	14.55	1.67	-0.97	74.5
Germany	5	0.33	0.52	0.47	0.03	2.40	9.80	9.66	0.77	78.8
	5-1	1.28	-0.85	0.33	0.09	4.36	-7.64	3.15	1.18	27.1
	1	0.08	0.76	0.45	0.00	0.34	8.87	6.03	-0.04	65.0
Austria	5	0.40	0.83	0.41	-0.06	2.03	12.12	6.75	-1.61	74.7
	5-1	0.32	0.08	-0.04	-0.06	0.98	0.69	-0.44	-0.95	-0.6
	1	-0.55	1.11	0.15	0.15	-3.39	18.34	2.56	3.43	84.8
Switzerland	5	0.38	1.05	0.11	-0.08	2.81	20.69	2.15	-2.26	85.4
	5-1	0.93	-0.06	-0.05	-0.24	3.56	-0.63	-0.48	-3.30	7.4
	1	-0.85	1.03	0.41	0.19	-4.36	16.85	7.00	4.24	84.2
France	5	0.31	0.95	0.18	-0.13	2.06	20.18	3.91	-3.73	84.6
	5-1	1.16	-0.08	-0.23	-0.33	4.19	-0.92	-2.81	-5.00	19.6
	1	-0.65	1.27	-0.12	-0.05	-2.84	13.76	-1.25	-0.89	79.4
Italy	5	0.54	0.75	0.22	-0.14	2.71	9.24	2.72	-3.13	77.0
	5-1	1.19	-0.52	0.34	-0.10	3.71	-3.97	2.59	-1.33	8.2
	1	-1.19	0.52	0.40	-0.08	-4.04	10.64	7.22	-0.66	87.4
Greece	5	0.97	0.55	0.43	-0.59	2.65	9.09	6.14	-4.01	82.9
	5-1	2.17	0.03	0.02	-0.51	4.49	0.40	0.25	-2.64	2.7
	1	-0.45	0.85	0.34	-0.10	-1.91	9.77	3.59	-1.57	77.3
Spain	5	0.20	0.73	0.16	-0.04	1.22	11.91	2.39	-0.99	79.6
	5-1	0.66	-0.12	-0.18	0.05	2.06	-1.01	-1.41	0.65	9.4
	1	-0.80	0.46	0.54	0.07	-2.40	5.59	8.75	0.82	61.1
Portugal	5	0.24	0.35	0.50	-0.18	0.70	4.06	7.84	-2.13	53.0
	5-1	1.02	-0.12	-0.04	-0.22	2.31	-1.05	-0.46	-1.98	2.2
	1	-0.46	1.05	0.14	0.15	-2.73	17.15	2.24	3.85	84.0
Netherlands	5	0.66	0.96	0.07	-0.06	3.93	15.70	1.15	-1.62	78.0
	5-1	1.13	-0.09	-0.07	-0.21	4.11	-0.91	-0.67	-3.37	9.3
	1	-0.66	1.10	0.19	0.04	-3.49	14.80	3.10	0.76	75.0
Belgium	5	0.52	0.92	0.27	-0.07	3.05	13.82	4.93	-1.55	76.2
	5-1	1.18	-0.18	0.08	-0.11	4.19	-1.60	0.89	-1.45	0.8
	1	-0.52	0.74	0.29	0.07	-2.10	13.51	4.22	1.81	75.5
Sweden	5	0.70	0.61	0.25	0.04	2.83	11.32	3.66	1.20	68.7
	5-1	1.22	-0.13	-0.04	-0.02	3.95	-1.86	-0.48	-0.50	4.0
	1	-0.51	0.73	0.32	0.19	-1.69	8.55	4.03	3.18	69.9
Norway	5	0.27	0.73	0.25	-0.02	0.95	9.94	3.51	-0.32	67.3
	5-1	1.06	-0.19	0.07	-0.20	2.67	-1.65	0.67	-2.48	3.9
	1	-0.70	0.84	0.49	-0.09	-2.99	8.16	6.19	-1.78	66.1
Denmark	5	0.65	0.89	0.25	-0.11	3.40	10.57	3.85	-2.84	67.2
	5-1	1.34	0.05	-0.24	-0.03	4.54	0.37	-2.40	-0.42	3.3
	1	-0.71	0.85	0.25	-0.05	-2.56	8.90	2.68	-1.53	75.9
Finland	5	0.54	0.32	0.57	-0.09	2.46	4.31	7.85	-3.94	77.6
	5-1	1.24	-0.52	0.32	-0.05	3.34	-4.07	2.60	-1.17	8.6

Table VI

Table VI
Time-Series-Regressions of Earnings Momentum Portfolios

The Table gives the results of a regression according to Equation (**??**) using 240 monthly returns ranging from July 1987 to June 2007 along with the according t-statistics. Portfolio 1 refers to the negative earnings revisions quintile, portfolio 5 refers to the positive earnings revision quintile, and portfolio 5-1 is the long-short portfolio (positive-negative).

		Fama-French Model								
		α	β	γ	δ	$t(\alpha)$	$t(\beta)$	$t(\gamma)$	$t(\delta)$	Adj. R^2
	1	-0.63	1.00	0.22	0.12	-6.10	27.17	5.30	3.38	92.5
USA	5	0.22	0.75	0.33	-0.01	1.80	17.50	6.85	-0.16	87.3
	5-1	0.85	-0.25	0.11	-0.12	6.15	-5.12	2.01	-2.67	14.5
	1	-0.15	0.72	0.38	0.14	-1.59	12.73	8.56	3.06	92.5
Europe	5	0.89	0.47	0.42	0.03	10.14	9.13	10.25	0.82	90.9
	5-1	1.05	-0.25	0.04	-0.10	9.68	-3.94	0.70	-2.07	24.3
	1	0.04	0.11	0.72	-0.08	0.36	1.27	8.60	-1.70	83.5
UK	5	0.85	-0.06	0.77	0.00	7.33	-0.65	9.46	0.07	80.8
	5-1	0.80	-0.17	0.06	0.08	6.00	-1.67	0.60	1.56	5.4
	1	-0.53	0.59	0.33	-0.11	-1.33	4.45	2.75	-1.98	45.7
Ireland	5	1.05	0.50	0.32	-0.05	3.75	5.93	3.92	-1.08	47.7
	5-1	1.45	-0.19	0.03	0.02	3.14	-1.24	0.24	0.34	0.2
	1	-0.66	0.84	0.40	0.08	-4.25	12.12	6.54	1.87	81.8
Germany	5	0.20	0.64	0.47	0.01	1.57	11.35	9.44	0.29	84.9
	5-1	0.87	-0.20	0.07	-0.07	5.80	-3.00	1.22	-1.71	4.8
	1	-0.17	1.02	0.37	0.08	-0.75	11.78	5.02	1.95	73.9
Austria	5	0.71	0.67	0.43	0.01	3.49	8.77	6.75	0.13	69.6
	5-1	0.89	-0.35	0.07	-0.08	3.07	-3.28	0.73	-1.48	7.9
	1	-0.50	1.33	0.00	0.01	-3.87	19.74	-0.01	0.33	89.2
Switzerland	5	0.31	0.85	0.22	0.00	2.99	15.62	4.52	-0.08	89.0
	5-1	0.81	-0.48	0.22	-0.01	4.37	-4.92	2.55	-0.27	14.8
	1	-0.68	1.05	0.25	0.16	-4.65	19.97	5.41	4.93	89.1
France	5	0.28	0.94	0.14	-0.01	2.25	20.61	3.39	-0.51	87.8
	5-1	1.00	-0.13	-0.10	-0.18	5.86	-2.18	-1.85	-4.51	21.7
	1	-0.32	0.88	0.15	0.08	-1.85	11.64	1.97	2.03	84.0
Italy	5	0.10	0.99	-0.07	0.07	0.65	14.78	-1.00	1.99	84.7
	5-1	0.42	0.10	-0.22	-0.01	2.03	1.14	-2.40	-0.24	4.4
	1	-0.38	0.52	0.45	-0.20	-1.24	10.21	7.63	-1.55	86.7
Greece	5	0.11	0.45	0.45	-0.33	0.37	9.45	8.25	-2.84	86.7
	5-1	0.45	-0.06	-0.01	-0.13	1.34	-1.10	-0.17	-0.95	3.0
	1	-0.66	0.78	0.41	-0.06	-3.87	11.84	5.83	-1.28	86.7
Spain	5	0.40	0.82	0.10	-0.05	1.95	10.80	1.23	-0.86	73.7
	5-1	1.03	-0.02	-0.25	0.01	3.65	-0.22	-2.11	0.15	9.5
	1	-1.02	0.43	0.60	0.01	-3.46	5.90	11.03	0.07	67.2
Portugal	5	0.04	0.45	0.44	-0.08	0.10	4.70	6.27	-0.81	45.9
	5-1	1.06	0.01	-0.16	-0.08	2.58	0.13	-2.09	-0.80	2.0
	1	-0.29	0.87	0.29	0.10	-1.92	12.78	4.66	2.86	85.6
Netherlands	5	0.79	0.90	0.06	-0.04	5.58	13.98	1.08	-1.34	80.5
	5-1	1.08	0.03	-0.23	-0.14	4.89	0.31	-2.47	-2.80	13.9
	1	-0.42	1.04	0.24	0.01	-2.42	11.91	3.68	0.25	76.6
Belgium	5	0.46	0.86	0.30	-0.03	3.21	12.23	5.72	-0.70	81.0
	5-1	0.88	-0.17	0.06	-0.04	4.19	-1.67	0.80	-0.68	0.7
	1	-0.50	0.62	0.32	0.11	-2.25	11.61	5.00	3.36	75.8
Sweden	5	0.43	0.41	0.40	0.10	2.09	8.34	6.71	3.30	71.7
	5-1	0.93	-0.21	0.08	-0.01	3.55	-3.32	1.02	-0.26	6.5
	1	-0.23	0.70	0.31	0.12	-0.82	8.72	4.22	2.17	71.2
Norway	5	0.44	0.51	0.30	0.04	1.75	7.09	4.42	0.74	64.8
	5-1	0.71	-0.18	-0.03	-0.07	2.16	-1.88	-0.35	-1.01	6.6
	1	-0.58	0.92	0.34	0.00	-3.26	10.77	5.34	0.00	73.8
Denmark	5	0.64	0.97	0.17	-0.05	3.00	9.47	2.20	-1.15	60.6
	5-1	1.23	0.05	-0.17	-0.05	4.32	0.37	-1.70	-0.87	1.3
	1	-0.52	0.80	0.26	0.03	-2.06	9.25	3.16	0.96	77.5
Finland	5	0.88	0.32	0.55	-0.02	4.15	4.40	7.73	-0.79	76.5
	5-1	1.40	-0.48	0.28	-0.05	4.44	-4.39	2.71	-1.30	10.1

Table VII
Accounting for Multiple Testing

The table gives the lower confidence band c_l for the returns as obtained by the StepM method and the FDP-StepM$_{0.1}$ using studentized test statistics as illustrated in Appendix A. The rej-columns contain the resulting decision where 1 indicates rejection of $\theta_s = 0$ (capital market efficiency). Panel A provides results for returns as test statistics and Panel B provides results for Fama-French alphas as test statistics.

Country		Price Momentum					Earnings Momentum			
	θ_s	StepM		FDP-StepM$_{0.1}$		θ_s	StepM		FDP-StepM$_{0.1}$	
		c_l	rej	c_l	rej		c_l	rej	c_l	rej
Panel A: Return										
USA	0.0079	0.0027	1	0.0048	1	0.0058	0.0018	1	0.0037	1
Europe	0.0119	0.0059	1	0.0082	1	0.0083	0.0046	1	0.0064	1
UK	0.0088	0.0024	1	0.0049	1	0.0078	0.0040	1	0.0058	1
Ireland	0.0039	-0.0040	0	-0.0010	0	0.0123	-0.0015	0	0.0051	1
Germany	0.0103	0.0033	1	0.0060	1	0.0076	0.0030	1	0.0052	1
Austria	0.0033	-0.0043	0	-0.0014	0	0.0058	-0.0028	0	0.0013	1
Switzerland	0.0079	0.0007	1	0.0035	1	0.0060	-0.0006	0	0.0025	1
France	0.0092	0.0027	1	0.0052	1	0.0077	0.0031	1	0.0053	1
Italy	0.0112	0.0043	1	0.0070	1	0.0036	-0.0021	0	0.0006	1
Greece	0.0216	0.0110	1	0.0151	1	0.0033	-0.0065	0	-0.0019	0
Spain	0.0046	-0.0029	0	0.0000	0	0.0085	0.0000	0	0.0040	1
Portugal	0.0070	-0.0017	0	0.0017	1	0.0088	-0.0008	0	0.0038	1
Netherlands	0.0087	0.0019	1	0.0046	1	0.0085	0.0006	1	0.0044	1
Belgium	0.0102	0.0034	1	0.0060	1	0.0075	0.0022	1	0.0047	1
Sweden	0.0105	0.0036	1	0.0063	1	0.0077	-0.0003	0	0.0035	1
Norway	0.0075	-0.0011	0	0.0022	1	0.0043	-0.0050	0	-0.0005	0
Denmark	0.0122	0.0059	1	0.0084	1	0.0116	0.0032	1	0.0072	1
Finland	0.0101	0.0017	1	0.0050	1	0.0118	0.0032	1	0.0073	1
Panel B: Fama-French Alpha										
USA	0.0101	0.0046	1	0.0067	1	0.0085	0.0054	1	0.0067	1
Europe	0.0146	0.0082	1	0.0106	1	0.0105	0.0079	1	0.0090	1
UK	0.0090	0.0037	1	0.0057	1	0.0080	0.0052	1	0.0063	1
Ireland	0.0040	-0.0041	0	-0.0011	0	0.0145	0.0030	1	0.0076	1
Germany	0.0128	0.0060	1	0.0086	1	0.0087	0.0049	1	0.0064	1
Austria	0.0032	-0.0036	0	-0.0010	0	0.0089	0.0030	1	0.0054	1
Switzerland	0.0093	0.0025	1	0.0051	1	0.0081	0.0035	1	0.0054	1
France	0.0116	0.0063	1	0.0083	1	0.0100	0.0063	1	0.0078	1
Italy	0.0119	0.0056	1	0.0080	1	0.0042	-0.0003	0	0.0015	1
Greece	0.0217	0.0120	1	0.0156	1	0.0045	-0.0031	0	0.0000	0
Spain	0.0066	0.0008	1	0.0030	1	0.0103	0.0042	1	0.0067	1
Portugal	0.0102	0.0006	1	0.0042	1	0.0106	0.0031	1	0.0061	1
Netherlands	0.0113	0.0057	1	0.0078	1	0.0108	0.0052	1	0.0074	1
Belgium	0.0118	0.0052	1	0.0077	1	0.0088	0.0045	1	0.0062	1
Sweden	0.0122	0.0055	1	0.0080	1	0.0093	0.0035	1	0.0058	1
Norway	0.0106	0.0025	1	0.0056	1	0.0071	0.0003	1	0.0030	1
Denmark	0.0134	0.0077	1	0.0099	1	0.0123	0.0055	1	0.0082	1
Finland	0.0124	0.0047	1	0.0076	1	0.0140	0.0077	1	0.0103	1
Σ		*Return*	13		15			9		16
		Alpha	16		16			16		17

Table VIII
Correlation of Price and Earnings Momentum Returns

The table gives correlation figures of quintile portfolio returns built monthly dependent on the price and earnings momentum ranking. We compare momentum portfolios that belong to the same quintile ranking. The p-Value arises from a test of zero correlation in the return of the respective portfolios. The two rightmost columns give the correlation coefficients for the return and the Fama-French alpha of both strategies.

Country		*Price-Earnings Momentum Ranking*					*Hedge Strategies*	
		Lowest	2	3	4	Highest	Return	Alpha
USA	Correlation	0.933	0.967	0.971	0.948	0.902	0.319	0.099
	p-Value	0	0	0	0	0	0	0.157
Europe	Correlation	0.952	0.978	0.970	0.976	0.932	0.651	0.825
	p-Value	0	0	0	0	0	0	0
UK	Correlation	0.898	0.952	0.959	0.956	0.869	0.161	0.521
	p-Value	0	0	0	0	0	0.013	0
Ireland	Correlation	0.749	0.772	0.830	0.754	0.804	0.348	0.624
	p-Value	0	0	0	0	0	0	0
Germany	Correlation	0.928	0.958	0.919	0.893	0.917	0.508	0.538
	p-Value	0	0	0	0	0	0	0
Austria	Correlation	0.813	0.848	0.881	0.867	0.864	0.262	0.573
	p-Value	0	0	0	0	0	0	0
Switzerland	Correlation	0.948	0.946	0.951	0.954	0.907	0.567	0.224
	p-Value	0	0	0	0	0	0	0.001
France	Correlation	0.952	0.969	0.966	0.962	0.935	0.670	0.630
	p-Value	0	0	0	0	0	0	0
Italy	Correlation	0.904	0.942	0.924	0.932	0.858	0.253	0.328
	p-Value	0	0	0	0	0	0	0
Greece	Correlation	0.924	0.968	0.964	0.960	0.932	0.076	0.095
	p-Value	0	0	0	0	0	0.344	0.273
Spain	Correlation	0.885	0.950	0.955	0.956	0.861	0.177	-0.439
	p-Value	0	0	0	0	0	0.007	0
Portugal	Correlation	0.866	0.830	0.867	0.873	0.783	0.280	0.573
	p-Value	0	0	0	0	0	0	0
Netherlands	Correlation	0.947	0.954	0.934	0.943	0.913	0.663	0.616
	p-Value	0	0	0	0	0	0	0
Belgium	Correlation	0.908	0.916	0.936	0.915	0.865	0.471	0.551
	p-Value	0	0	0	0	0	0	0
Sweden	Correlation	0.878	0.913	0.915	0.937	0.881	0.318	0.486
	p-Value	0	0	0	0	0	0	0
Norway	Correlation	0.847	0.891	0.834	0.854	0.852	0.240	0.617
	p-Value	0	0	0	0	0	0	0
Denmark	Correlation	0.861	0.888	0.869	0.813	0.839	0.454	0.313
	p-Value	0	0	0	0	0	0	0
Finland	Correlation	0.895	0.907	0.902	0.876	0.899	0.541	0.528
	p-Value	0	0	0	0	0	0	0

Table IX
Time-Series-Regressions of Price Momentum Portfolios

The table's left panel gives the results of a regression according to Equation (**??**) using 240 monthly returns ranging from July 1987 to June 2007 followed by the according t-statistics. The right panel gives the results of a regression according to Equation (4). We use the country abbreviations introduced in Table I. We give the quintile portfolios 1 (loser) to 5 (winner) together with the long-short portfolio (winner-loser).

					Fama-French Model										4-Factor Model					
	α	β	γ	δ	$t(\alpha)$	$t(\beta)$	$t(\gamma)$	$t(\delta)$	Adj. R^2	α	β	γ	δ	ζ	$t(\alpha)$	$t(\beta)$	$t(\gamma)$	$t(\delta)$	$t(\zeta)$	Adj. R^2
USA 1	-0.90	1.00	0.34	0.08	-5.29	19.38	5.43	1.28	84.5	-0.80	0.99	0.32	0.06	-0.17	-4.20	15.09	4.58	0.94	-2.02	83.7
USA 2	-0.24	0.75	0.14	0.21	-2.10	21.70	3.30	5.33	84.8	-0.30	0.72	0.18	0.23	0.16	-2.38	16.68	4.03	6.01	2.83	83.7
USA 3	-0.07	0.69	0.07	0.19	-0.63	19.44	1.63	4.75	80.3	-0.17	0.63	0.15	0.23	0.27	-1.43	15.39	3.54	6.22	5.10	80.5
USA 4	-0.04	0.70	0.12	0.07	-0.34	18.99	2.64	1.57	81.0	-0.15	0.62	0.22	0.11	0.32	-1.33	15.50	5.31	3.07	6.38	83.0
USA 5	0.11	0.82	0.34	-0.30	0.63	15.64	5.45	-5.06	81.0	0.01	0.74	0.45	-0.26	0.30	0.04	11.69	6.73	-4.53	3.74	80.9
USA 5-1	1.01	-0.18	0.01	-0.38	3.57	-2.07	0.08	-3.88	7.0	0.80	-0.25	0.13	-0.32	0.47	2.65	-2.42	1.17	-3.31	3.51	14.5
EUR 1	-0.41	0.76	0.41	0.21	-2.54	8.23	5.55	2.76	84.6	0.36	0.64	0.41	0.11	-0.81	2.22	7.63	6.47	1.68	-9.71	88.6
EUR 2	0.15	0.41	0.46	0.16	1.74	8.50	11.76	4.06	92.3	0.35	0.37	0.45	0.15	-0.19	3.50	7.35	11.62	3.75	-3.66	91.7
EUR 3	0.47	0.30	0.49	0.06	6.01	6.86	13.76	1.53	92.4	0.40	0.30	0.49	0.08	0.11	4.41	6.54	13.87	2.29	2.31	91.7
EUR 4	0.64	0.33	0.49	-0.05	7.64	6.94	12.85	-1.38	91.7	0.41	0.36	0.49	-0.01	0.27	4.51	7.74	13.75	-0.25	5.84	91.9
EUR 5	1.05	0.52	0.45	-0.20	7.82	6.80	7.32	-3.19	84.7	0.52	0.62	0.44	-0.13	0.56	3.60	8.41	7.77	-2.25	7.55	85.6
EUR 5-1	1.46	-0.24	0.04	-0.41	5.84	-1.68	0.33	-3.49	9.4	0.16	-0.02	0.03	-0.24	1.37	0.66	-0.13	0.27	-2.49	11.13	42.9
UK 5-1	0.90	0.60	-0.62	-0.32	4.02	3.65	-3.99	-3.64	12.0	0.71	0.65	-0.66	-0.34	0.32	2.95	3.83	-4.19	-3.81	2.94	15.3
IRL 5-1	0.40	0.22	-0.27	-0.15	1.00	2.17	-2.51	-2.34	4.5	0.41	-0.08	-0.01	-0.20	0.32	1.01	-0.62	-0.08	-3.37	4.71	16.8
GER 5-1	1.28	-0.85	0.33	0.09	4.36	-7.64	3.15	1.18	27.1	0.53	-0.82	0.37	0.16	0.97	1.91	-6.95	3.68	2.28	8.45	44.2
A 5-1	0.32	0.08	-0.04	-0.06	0.98	0.69	-0.44	-0.95	-0.6	0.05	0.29	-0.12	-0.04	0.33	0.17	2.41	-1.26	-0.75	4.56	8.0
CH 5-1	0.93	-0.06	-0.05	-0.24	3.56	-0.63	-0.48	-3.30	7.4	0.45	-0.08	0.07	-0.18	0.73	1.92	-0.63	0.64	-3.00	9.11	34.2
FR 5-1	1.16	-0.08	-0.23	-0.33	4.19	-0.92	-2.81	-5.00	19.6	0.23	0.00	-0.10	-0.16	0.98	0.90	-0.02	-1.28	-2.77	10.83	46.7
IL 5-1	1.19	-0.52	0.34	-0.10	3.71	-3.97	2.59	-1.33	8.2	1.07	-0.62	0.49	-0.10	0.40	3.37	-4.51	3.50	-1.44	3.98	14.3
GR 5-1	2.17	0.03	0.02	-0.51	4.49	0.40	0.25	-2.64	2.7	2.11	0.04	0.02	-0.50	0.11	4.33	0.49	0.27	-2.56	0.92	2.6
ES 5-1	0.66	-0.12	-0.18	0.05	2.06	-1.01	-1.41	0.65	9.4	0.54	-0.29	0.01	0.03	0.09	1.70	-2.44	0.06	0.42	1.19	11.8
POR 5-1	1.02	-0.12	-0.04	-0.22	2.31	-1.05	-0.46	-1.98	2.2	0.70	-0.12	0.01	-0.19	0.27	1.59	-1.11	0.10	-1.73	3.49	8.3
NL 5-1	1.13	-0.09	-0.07	-0.21	4.11	-0.91	-0.67	-3.37	9.3	0.24	-0.03	0.05	-0.11	0.79	1.02	-0.33	0.54	-2.19	12.06	44.2
BEL 5-1	1.18	-0.18	0.08	-0.11	4.19	-1.60	0.89	-1.45	0.8	0.74	-0.27	0.16	-0.08	0.63	2.78	-2.09	1.74	-1.11	7.83	22.8
SWE 5-1	1.22	-0.13	-0.04	-0.02	3.95	-1.86	-0.48	-0.50	4.0	0.95	-0.16	0.03	-0.03	0.30	3.18	-2.18	0.32	-0.76	4.11	12.6
NOR 5-1	1.06	-0.19	0.07	-0.20	2.67	-1.65	0.67	-2.48	3.9	0.89	-0.12	0.06	-0.17	0.25	2.26	-1.04	0.55	-2.11	3.13	6.8
DK 5-1	1.34	0.05	-0.24	-0.03	4.54	0.37	-2.40	-0.42	3.3	0.82	0.00	-0.15	0.00	0.47	2.87	0.01	-1.54	0.03	7.36	21.5
FN 5-1	1.24	-0.52	0.32	-0.05	3.34	-4.07	2.60	-1.17	8.6	0.48	-0.24	0.15	-0.02	0.57	1.41	-2.07	1.39	-0.62	8.04	29.8

Table X

Time-Series-Regressions of Earnings Momentum Portfolios

The table's left panel gives the results of a regression according to Equation (**??**) using 240 monthly returns ranging from July 1987 to June 2007 followed by the according t-statistics. The right panel gives the results of a regression according to Equation (5). We use the country abbreviations introduced in Table I. We give the quintile portfolios 1 (negative earnings revisions) to 5 (positive earnings revisions) together with the long-short portfolio (positive-negative earnings revisions).

			Fama-French Model										4-Factor Model							
	α	β	γ	δ	$t(\alpha)$	$t(\beta)$	$t(\gamma)$	$t(\delta)$	Adj. R^2	α	β	γ	δ	ζ	$t(\alpha)$	$t(\beta)$	$t(\gamma)$	$t(\delta)$	$t(\zeta)$	Adj. R^2
USA 1	-0.63	1.00	0.22	0.12	-6.10	27.17	5.30	3.38	92.5	-0.57	0.98	0.23	0.10	-0.05	-5.35	26.13	5.54	2.76	-2.18	92.6
2	-0.37	0.70	0.28	0.09	-3.88	20.55	7.41	2.91	89.9	-0.30	0.68	0.29	0.07	-0.06	-3.02	19.62	7.80	2.13	-2.95	90.3
3	-0.18	0.52	0.31	0.07	-1.60	12.85	6.99	1.78	82.2	-0.11	0.49	0.32	0.05	-0.06	-0.97	12.08	7.25	1.20	-2.23	82.5
4	0.06	0.56	0.33	-0.12	0.46	12.89	6.96	-2.88	82.4	0.09	0.55	0.34	-0.13	-0.03	0.69	12.32	7.01	-3.02	-0.92	82.4
5	0.22	0.75	0.33	-0.01	1.80	17.50	6.85	-0.16	87.3	0.15	0.77	0.32	0.01	0.06	1.20	17.62	6.65	0.36	2.08	87.5
5-1	0.85	-0.25	0.11	-0.12	6.15	-5.12	2.01	-2.67	14.5	0.72	-0.21	0.09	-0.08	0.11	5.14	-4.28	1.68	-1.78	3.51	18.5
EUR 1	-0.15	0.72	0.38	0.14	-1.59	12.73	8.56	3.06	92.5	0.10	0.66	0.39	0.08	-0.16	1.08	12.70	9.69	1.82	-6.98	93.7
2	0.13	0.47	0.49	0.00	1.77	10.84	14.08	0.04	94.3	0.28	0.44	0.49	-0.03	-0.09	3.60	10.45	14.95	-0.98	-4.89	94.8
3	0.34	0.36	0.48	-0.06	4.57	8.23	13.66	-1.67	92.8	0.42	0.35	0.48	-0.08	-0.04	5.12	7.75	13.90	-2.14	-2.23	92.9
4	0.57	0.34	0.48	-0.11	6.97	7.03	12.65	-2.98	91.0	0.49	0.36	0.48	-0.09	0.05	5.58	7.39	12.67	-2.44	2.39	91.2
5	0.89	0.47	0.42	0.03	10.14	9.13	10.25	0.82	90.9	0.74	0.51	0.41	0.07	0.09	8.06	10.00	10.43	1.71	4.21	91.5
5-1	1.05	-0.25	0.04	-0.10	9.68	-3.94	0.70	-2.07	24.3	0.64	-0.16	0.02	-0.01	0.26	6.76	-3.05	0.40	-0.17	11.13	50.6
UK 5-1	0.80	-0.17	0.06	0.08	6.00	-1.67	0.60	1.56	5.4	0.70	-0.24	0.13	0.12	0.11	5.08	-2.31	1.34	2.20	2.94	8.4
IRL 5-1	1.45	-0.19	0.03	0.02	3.14	-1.24	0.24	0.34	0.2	1.11	-0.14	0.04	0.10	0.39	2.49	-0.93	0.27	1.45	4.71	11.9
GER5-1	0.87	-0.20	0.07	-0.07	5.80	-3.00	1.22	-1.71	4.8	0.53	0.05	-0.04	-0.09	0.24	3.89	0.75	-0.71	-2.60	8.45	27.0
A 5-1	0.89	-0.35	0.07	-0.08	3.07	-3.28	0.73	-1.48	7.9	0.80	-0.40	0.09	-0.06	0.25	2.88	-3.82	1.05	-1.19	4.56	15.2
CH 5-1	0.81	-0.48	0.22	-0.01	4.37	-4.92	2.55	-0.27	14.8	0.43	-0.32	0.14	0.06	0.37	2.62	-3.79	1.83	1.29	9.11	37.1
FR 5-1	1.00	-0.13	-0.10	-0.18	5.86	-2.18	-1.85	-4.51	21.7	0.58	-0.09	-0.03	-0.06	0.34	4.05	-1.75	-0.75	-1.88	10.83	47.9
IL 5-1	0.42	0.10	-0.22	-0.01	2.03	1.14	-2.40	-0.24	4.4	0.22	0.20	-0.28	0.01	0.16	1.07	2.17	-3.16	0.14	3.98	10.1
GR 5-1	0.45	-0.06	-0.01	-0.13	1.34	-1.10	-0.17	-0.95	3.0	0.42	-0.07	-0.02	-0.10	0.05	1.18	-1.22	-0.25	-0.69	0.92	3.8
ES 5-1	1.03	-0.02	-0.25	0.01	3.65	-0.22	-2.11	0.15	9.5	0.98	0.00	-0.25	0.01	0.07	3.47	-0.02	-2.11	0.12	1.19	9.7
POR5-1	1.06	0.01	-0.16	-0.08	2.58	0.13	-2.09	-0.80	2.0	0.94	0.04	-0.16	-0.07	0.25	2.26	0.35	-2.11	-0.65	3.49	8.9
NL 5-1	1.08	0.03	-0.23	-0.14	4.89	0.31	-2.47	-2.80	13.9	0.55	0.04	-0.16	-0.03	0.49	3.05	0.45	-2.26	-0.78	12.06	47.1
BEL5-1	0.88	-0.17	0.06	-0.04	4.19	-1.67	0.80	-0.68	0.7	0.45	-0.05	-0.01	0.00	0.34	2.29	-0.50	-0.08	-0.09	7.83	21.3
SWE5-1	0.93	-0.21	0.08	-0.01	3.55	-3.32	1.02	-0.26	6.5	0.65	-0.16	0.07	0.00	0.23	2.48	-2.56	0.90	-0.05	4.11	12.5
NOR5-1	0.71	-0.18	-0.03	-0.07	2.16	-1.88	-0.35	-1.01	6.6	0.53	-0.15	-0.04	-0.04	0.17	1.62	-1.62	-0.45	-0.55	3.13	10.1
DK 5-1	1.23	0.05	-0.17	-0.05	4.32	0.37	-1.70	-0.87	1.3	0.66	0.04	-0.08	-0.04	0.41	2.47	0.32	-0.85	-0.80	7.36	19.8
FN 5-1	1.40	-0.48	0.28	-0.05	4.44	-4.39	2.71	-1.30	10.1	0.82	-0.27	0.16	-0.02	0.41	2.88	-2.74	1.73	-0.81	8.04	31.4

Table XI
Momentum and the Macroeconomy

The Table gives the results of a regression of 12-month ahead growth in real GDP on 12-month compounded momentum MOM and Fama-French factors MKT, SMB, and HML. GDP growth is measured as the change in the log of GDP and given that GDP is available on a quarterly basis the regressions are also on a quarterly basis. The regressions' intercept is denoted by ICT. Since the regressions rely on overlapping data the reported t-statistics are based on Newey-West standard errors. The upper Panel refers to price momentum and the lower panel refers to earnings momentum. The sample period is from July 1987 to June 2007.

	Coefficients					t-statistics					
	ICPT	MOM	MKT	SMB	HML	ICPT	MOM	MKT	SMB	HML	Adj. R^2
Panel A: Price Momentum											
USA	0.037	-0.045	-0.014	0.020	-0.036	7.46	-1.32	-0.68	0.71	-2.31	11.01
Europe	0.014	0.023	0.051	-0.032	-0.030	2.91	1.86	1.38	-0.84	-1.31	45.40
UK	0.019	0.031	0.003	0.023	0.021	2.97	2.33	0.14	0.70	0.71	14.29
Ireland	0.071	-0.034	0.062	-0.082	-0.030	11.38	-2.46	1.58	-1.71	-1.84	21.53
Germany	0.013	0.000	0.041	-0.025	0.003	2.64	0.00	0.78	-0.56	0.19	10.03
Austria	0.021	-0.005	-0.002	0.019	0.005	5.67	-0.75	-0.07	0.90	0.33	13.74
Switzerland	0.014	-0.003	0.103	-0.076	-0.014	3.24	-0.32	3.43	-3.32	-1.03	25.03
France	0.018	0.006	-0.013	0.033	-0.008	2.57	0.40	-0.36	0.98	-0.94	10.51
Italy	0.013	0.010	0.098	-0.084	0.009	2.26	0.66	2.89	-2.42	0.91	18.00
Greece	0.047	-0.009	0.011	-0.010	-0.026	24.56	-2.33	0.75	-0.82	-1.91	15.48
Spain	0.070	-0.017	-0.009	0.019	0.015	16.81	-1.08	-1.12	1.36	0.96	11.32
Portugal	0.024	-0.019	-0.022	0.037	-0.024	1.72	-1.01	-0.84	3.78	-0.65	25.50
Netherlands	0.021	0.023	0.085	-0.062	0.008	4.90	1.37	2.32	-2.19	0.50	30.35
Belgium	0.010	0.026	0.036	-0.010	0.040	3.26	4.43	1.26	-0.31	1.85	52.03
Sweden	0.029	0.006	-0.014	0.034	-0.001	7.32	0.35	-0.90	1.46	-0.13	8.62
Norway	0.030	-0.023	0.039	-0.045	-0.006	6.50	-1.47	1.60	-1.72	-0.39	21.69
Denmark	0.025	-0.018	0.017	-0.009	-0.006	3.23	-0.89	0.49	-0.38	-0.36	-1.06
Finland	0.018	0.035	-0.021	0.064	-0.029	1.78	1.09	-1.27	4.51	-1.84	38.95
Panel B: Earnings Momentum											
USA	0.022	0.086	0.030	-0.029	-0.019	4.48	2.75	1.31	-0.93	-1.26	27.10
Europe	0.007	0.083	0.076	-0.055	-0.027	1.30	2.78	2.95	-1.72	-1.36	51.14
UK	0.022	0.010	0.009	0.013	0.007	2.84	0.36	0.34	0.28	0.22	6.56
Ireland	0.058	0.003	0.075	-0.082	-0.002	10.62	0.17	1.85	-1.84	-0.11	0.20
Germany	0.009	0.031	0.045	-0.029	0.007	1.78	1.25	1.14	-0.73	0.52	15.82
Austria	0.024	-0.021	-0.013	0.030	0.004	11.07	-1.66	-0.57	1.93	0.29	30.21
Switzerland	0.012	0.015	0.119	-0.086	-0.021	3.93	1.06	3.19	-3.21	-1.30	26.21
France	0.018	0.016	-0.015	0.036	-0.007	2.00	0.63	-0.37	0.96	-0.85	11.40
Italy	0.014	0.012	0.104	-0.091	0.010	2.35	0.45	2.61	-2.28	1.04	17.93
Greece	0.046	-0.012	0.004	-0.002	-0.028	43.25	-1.54	0.28	-0.19	-4.34	31.10
Spain	0.069	0.008	-0.019	0.029	0.016	15.64	0.55	-1.85	1.78	0.98	7.62
Portugal	0.009	0.039	-0.017	0.029	0.020	0.87	2.71	-0.82	1.97	0.52	35.98
Netherlands	0.023	0.003	0.102	-0.072	0.007	5.10	0.14	2.63	-2.14	0.38	22.54
Belgium	0.013	0.024	0.037	-0.012	0.042	2.96	2.34	1.15	-0.36	1.70	32.13
Sweden	0.026	0.020	-0.014	0.040	-0.002	5.25	1.42	-0.90	1.63	-0.26	16.26
Norway	0.028	-0.024	0.048	-0.061	0.010	7.84	-1.53	2.27	-2.78	0.66	20.43
Denmark	0.023	-0.003	0.014	-0.007	-0.010	3.09	-0.19	0.45	-0.32	-0.68	-3.65
Finland	0.021	0.009	-0.034	0.078	-0.026	1.99	0.24	-2.09	4.19	-2.20	33.60

Table XII
Momentum and Information Uncertainty

The table gives return differentials of the price and earnings momentum hedge strategies by terciles of different information uncertainty metrics. In Panel A we first sort stocks into five quintiles based on past returns. For each quintile the stocks are further sorted into three terciles based on analyst coverage, size, total stock volatility and idiosyncratic volatility. Below the return differentials we give t-statistics. The last two rows collect the number of countries that exhibit the highest return differential among the respective terciles and the terciles mean ranking in terms of returns. Panel B gives analogous results for earnings momentum.

Country	Analyst Coverage			Size			Volatility			Idiosyncratic		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
Panel A: Price Momentum												
USA	1.38	1.04	0.87	1.53	0.91	0.48	0.29	1.02	1.28	0.97	0.98	1.41
	5.77	4.15	2.69	6.87	3.24	1.37	1.69	3.93	4.62	3.01	3.79	5.49
Europe	1.66	1.69	1.16	2.10	1.41	1.04	1.07	1.47	1.60	1.47	1.22	1.71
	6.77	7.21	4.83	7.54	5.46	3.87	6.15	6.39	6.25	5.50	5.23	6.74
UK	1.50	1.44	0.67	1.56	1.25	0.50	0.77	0.99	1.42	1.12	1.24	1.31
	4.83	4.55	2.02	4.95	4.15	1.57	3.86	3.39	4.73	3.90	4.33	4.49
Germany	0.98	1.14	1.04	1.48	1.03	0.78	0.75	0.94	1.11	1.29	0.99	1.36
	3.40	4.10	3.32	4.46	3.01	2.24	2.86	3.54	3.45	3.49	3.06	4.39
Switzerland	1.42	1.60	1.21	1.41	1.20	0.77	1.83	1.33	1.46	1.76	1.00	1.53
	4.38	5.36	4.18	4.14	3.67	2.37	5.98	4.63	4.90	5.25	3.79	4.95
France	1.21	1.24	0.82	1.75	1.32	0.46	1.32	1.16	1.21	1.45	1.06	1.51
	3.98	3.94	2.72	5.53	3.97	1.38	5.87	4.17	3.80	4.21	3.20	5.11
Italy	1.13	1.63	0.68	1.60	0.93	0.85	0.10	0.96	1.21	1.24	0.97	1.21
	2.55	3.67	1.74	3.62	1.92	1.84	0.25	2.50	2.86	2.78	2.27	2.94
Spain	0.90	0.51	0.13	1.45	0.79	-0.04	0.94	0.69	0.62	0.58	0.35	0.64
	1.90	1.32	0.29	2.33	1.96	-0.11	2.25	2.11	1.40	1.52	0.97	1.64
Netherlands	1.24	0.95	0.82	1.08	1.00	0.57	0.90	0.77	1.13	1.00	0.72	1.22
	3.79	2.89	2.38	3.37	2.86	1.46	2.83	2.73	3.30	2.91	2.43	3.77
Sweden	0.93	1.30	0.73	0.83	1.79	0.62	0.98	0.91	1.10	1.32	0.64	1.02
	1.96	3.38	1.92	1.79	3.77	1.44	2.97	2.27	3.02	3.00	1.62	2.52
Denmark	0.60	0.97	1.01	0.42	1.66	1.29	1.55	0.60	0.91	1.44	0.54	1.16
	1.56	3.41	3.48	1.07	3.66	3.47	4.24	2.10	3.02	3.51	1.99	3.39
# max	4	6	1	9	2	0	4	0	7	4	0	7
ranking	1.82	1.45	2.73	1.27	1.82	2.91	2.09	2.45	1.45	1.82	2.82	1.36
Panel B: Earnings Momentum												
USA	1.04	0.60	0.16	1.08	0.58	0.24	0.48	0.52	0.68	0.50	0.63	0.70
	7.41	3.77	0.75	7.02	3.55	1.22	3.99	3.87	4.62	3.56	4.28	4.26
Europe	0.92	1.00	0.58	1.20	0.71	0.70	0.68	0.68	0.88	0.87	0.89	0.89
	8.42	7.35	3.48	8.09	6.06	4.42	6.51	6.73	7.07	7.62	7.97	5.99
UK	1.22	1.00	0.29	1.50	0.83	0.35	0.61	0.59	0.93	0.62	0.89	1.00
	5.71	4.66	1.52	6.50	4.16	1.70	3.80	3.28	5.05	3.99	4.73	4.48
Germany	0.83	0.92	0.55	1.01	0.83	0.24	0.76	0.76	0.70	0.79	0.72	0.73
	3.09	3.96	2.16	3.50	3.71	1.26	4.02	4.31	3.37	4.06	3.77	2.94
Switzerland	0.57	0.80	0.69	0.95	0.46	0.66	0.45	0.31	0.76	0.65	0.60	0.71
	1.95	2.86	2.35	3.09	1.83	2.36	2.20	1.30	2.98	2.83	2.51	2.23
France	0.45	0.99	0.60	0.60	0.78	0.66	0.92	0.67	0.67	0.86	0.89	0.73
	1.86	3.39	2.16	1.92	3.17	2.60	4.48	3.04	3.04	4.23	3.84	2.71
Italy	0.03	0.66	0.52	0.03	0.52	0.33	-0.13	0.57	0.03	0.28	0.84	0.45
	0.11	1.85	1.69	0.09	1.53	1.01	-0.54	2.02	0.11	0.96	2.89	1.19
Spain	0.73	0.71	1.00	1.64	0.16	0.75	0.65	0.88	1.23	1.12	0.83	0.44
	2.11	1.86	1.84	2.42	0.47	2.31	2.75	2.60	2.72	3.43	2.16	1.19
Netherlands	1.26	1.17	0.04	1.39	1.08	0.06	0.97	0.60	0.52	1.01	0.82	1.11
	4.47	3.50	0.13	4.43	3.45	0.14	3.41	2.13	1.82	4.02	2.89	3.21
Sweden	1.01	1.61	0.51	0.93	1.75	-0.06	1.02	0.90	0.93	0.42	0.88	1.20
	2.89	4.59	1.24	2.92	4.63	-0.15	3.60	2.69	3.07	1.33	2.46	3.08
Denmark	1.22	0.94	0.93	1.32	1.13	0.74	2.19	0.67	1.12	1.57	1.34	0.89
	2.80	1.88	2.41	1.61	3.33	2.31	1.91	2.06	3.36	2.81	4.93	2.29
# max	4	6	1	8	3	0	5	2	5	3	3	6
ranking	1.91	1.55	2.55	1.45	1.91	2.64	1.82	2.18	1.73	2.18	2.00	1.73

Table XIII
Momentum and Liquidity

The table gives return differentials of the price and earnings momentum hedge strategies by terciles of different liquidity metrics. In Panel A we first sort stocks into five quintiles based on past returns. For each quintile the stocks are further sorted into three terciles based on dollar volume, share turnover, the ILLIQ measure of Amihud, and Liu's measure. Below the return differentials we give *t*-statistics. The two last rows collect the number of countries that exhibit the highest return differential among the respective terciles and the terciles mean ranking in terms of returns. Panel B gives analogous results for earnings momentum.

Country	Dollar Volume			Share Turnover			ILLIQ			Liu Measure		
	High	Mid	Low	High	Mid	Low	Low	Mid	High	Low	Mid	High
Panel A: Price Momentum												
USA	0.72	0.92	1.15	1.08	0.70	0.76	0.63	0.97	1.29	0.94	0.56	1.34
	2.06	3.42	5.61	3.55	2.80	3.57	1.81	3.56	5.66	3.21	2.08	5.96
Europe	1.25	1.55	1.36	1.63	1.18	1.19	1.23	1.55	1.39	1.41	1.33	1.49
	4.64	6.24	6.87	6.00	5.14	6.02	4.70	6.01	6.62	5.18	5.40	7.47
UK	0.91	1.19	1.29	1.18	1.00	1.19	0.88	1.16	1.33	1.02	1.02	1.29
	3.12	4.23	4.59	4.15	3.66	4.22	3.04	3.98	4.85	3.70	3.60	4.58
Germany	1.14	1.15	1.06	1.21	1.03	0.87	1.08	1.07	1.16	1.07	1.17	1.11
	3.33	3.82	4.29	3.74	3.61	3.79	3.50	3.16	4.17	3.23	4.04	4.51
Switzerland	1.51	0.85	1.15	1.34	0.97	1.17	1.33	1.01	1.18	1.29	1.17	1.19
	4.20	2.75	3.82	3.78	3.29	4.56	3.79	3.07	3.99	3.78	3.67	4.11
France	0.66	1.36	1.22	1.08	1.25	0.95	0.71	1.38	1.14	1.06	1.22	1.06
	1.94	4.52	4.42	3.30	4.25	3.50	2.09	4.37	4.29	3.26	3.98	3.71
Italy	1.39	1.30	0.65	1.16	0.82	0.61	1.16	1.17	0.88	1.34	1.34	0.72
	3.18	3.09	1.65	2.56	2.15	1.57	2.79	2.76	2.29	2.80	3.84	1.53
Spain	0.35	0.33	0.98	0.78	0.54	0.16	0.23	0.34	0.93	0.69	0.08	0.51
	0.87	0.87	1.80	1.87	1.31	0.43	0.54	0.86	2.02	1.72	0.21	1.09
Netherlands	0.67	0.79	1.24	0.75	0.89	1.15	0.73	0.95	0.89	0.80	1.23	0.60
	1.69	2.14	3.70	1.98	2.85	3.43	1.80	2.78	2.87	2.09	3.52	1.97
Sweden	1.02	1.52	0.27	1.47	0.92	-0.18	1.10	0.92	0.40	1.25	0.84	0.58
	2.50	3.25	0.58	3.42	2.26	-0.45	2.63	2.06	0.94	2.94	2.03	1.44
Denmark	1.16	0.95	0.92	1.08	0.76	1.34	1.32	0.97	0.72	1.26	1.18	0.79
	3.57	3.06	2.42	3.12	2.44	3.61	4.14	3.14	2.09	3.60	3.71	1.97
# max	3	4	4	7	1	3	3	4	5	5	4	3
ranking	2.18	1.82	2.00	1.45	2.36	2.18	2.27	1.82	1.82	1.64	2.00	2.09
Panel B: Earnings Momentum												
USA	0.27	0.45	0.97	0.31	0.57	0.79	0.23	0.54	1.01	0.4	0.42	1.02
	1.38	2.62	6.96	1.55	3.66	5.94	1.19	3.16	6.97	2.11	2.58	8.18
Europe	0.77	0.86	0.90	0.91	0.74	0.91	0.79	0.80	0.94	0.89	0.83	0.95
	4.85	6.84	8.17	6.14	5.56	8.59	5.40	6.27	8.20	5.67	6.73	9.68
UK	0.89	0.87	1.00	1.07	0.65	0.97	0.88	0.98	0.92	0.88	0.78	1.03
	5.11	5.18	5.51	6.38	4.08	5.14	5.42	5.70	5.04	5.38	4.70	5.61
Germany	0.56	0.83	0.98	0.80	0.68	0.91	0.54	0.80	0.82	0.60	0.79	0.80
	2.78	4.76	4.05	3.75	4.07	4.57	2.87	4.52	3.39	3.11	4.76	3.25
Switzerland	0.71	0.48	0.64	0.78	0.43	0.66	0.85	0.23	0.54	0.72	0.47	0.73
	2.42	1.76	2.38	2.59	1.67	2.65	2.95	0.75	2.07	2.41	1.82	2.76
France	0.38	0.93	0.49	0.65	0.78	0.73	0.69	0.74	0.53	0.70	1.01	0.39
	1.32	4.30	2.11	2.48	3.42	3.32	2.69	3.16	2.38	2.58	4.83	1.75
Italy	0.86	0.25	-0.05	0.93	0.07	0.13	0.80	0.21	-0.08	0.62	0.13	0.13
	3.09	0.87	-0.15	2.62	0.25	0.46	3.02	0.76	-0.24	2.02	0.47	0.45
Spain	1.00	0.88	0.92	1.11	0.78	0.88	0.85	0.89	1.05	0.85	0.90	0.99
	1.96	2.05	2.34	2.37	1.91	2.38	2.06	2.17	2.70	1.88	2.37	2.47
Netherlands	0.40	0.77	1.37	0.42	0.50	1.42	0.56	1.07	0.99	0.57	0.97	1.04
	0.99	2.15	5.22	1.23	1.68	4.89	1.35	3.35	3.69	1.64	2.69	4.03
Sweden	0.39	0.65	0.97	0.64	0.94	0.84	0.54	0.63	1.15	0.59	1.01	0.87
	0.91	1.92	2.60	1.56	2.43	2.40	1.28	1.87	3.12	1.33	3.34	2.33
Denmark	0.97	1.66	2.36	1.15	1.25	2.26	1.25	1.46	1.85	1.43	1.65	1.77
	2.13	3.76	2.58	2.62	2.26	2.75	2.56	2.91	2.84	2.20	4.07	2.47
# max	3	1	7	5	2	5	2	3	6	1	2	8
ranking	2.36	2.18	1.45	2.00	2.36	1.55	2.45	1.91	1.64	2.45	2.09	1.36

Figure 1. Cumulative Momentum Returns: Quintile and Hedge Portfolios

The upper graphs give cumulative total returns to the winner and loser quintiles of the earnings momentum strategy in terms of a highlighted spread while the returns of the price momentum winners and losers are added as dashed lines. The performance of an equally-weighted market portfolio is given by the solid line. The lower graphs give cumulative total returns to the price momentum strategy (dashed line) and to the earnings momentum strategy (solid line). Results are for the period from July 1987 to June 2007.
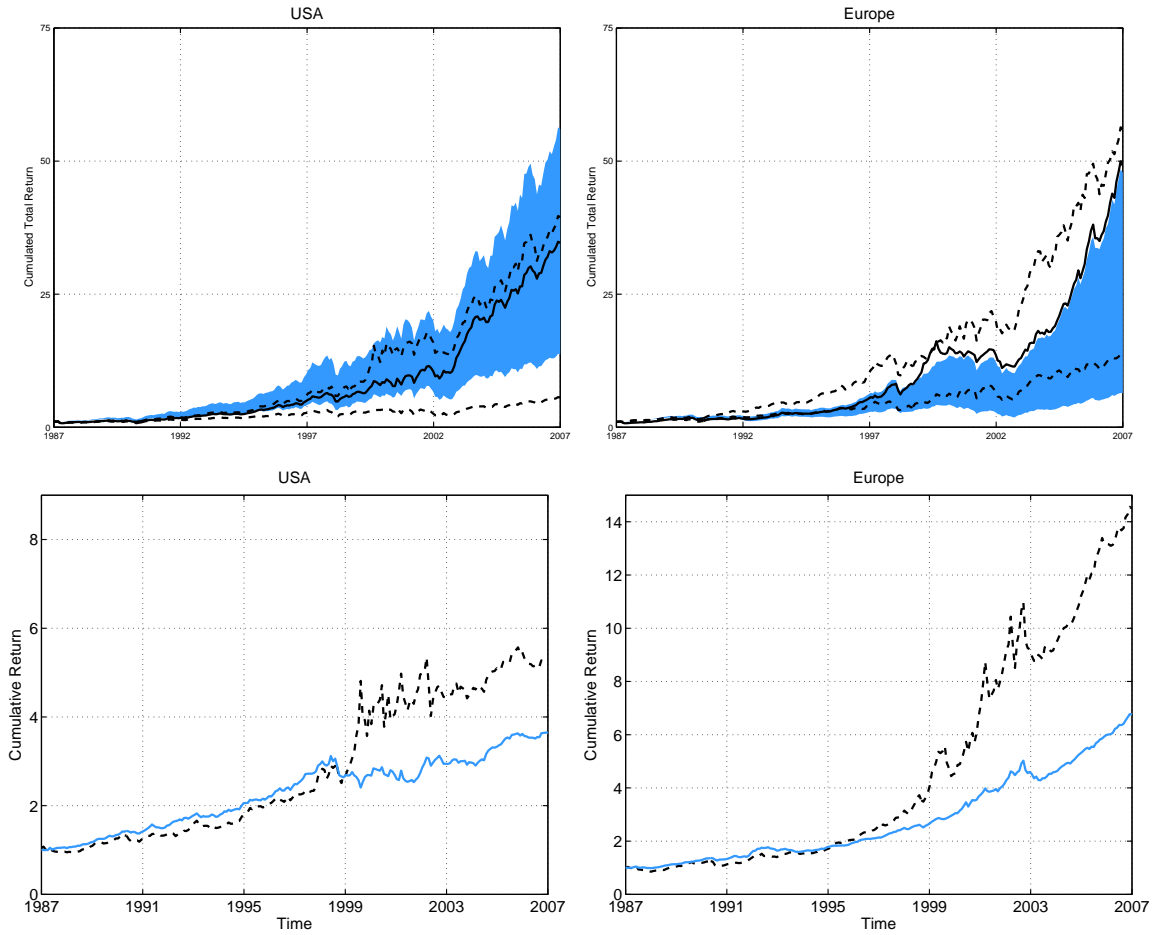

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Figure 2. Trailing Alphas of Momentum Hedge Portfolios

We plot trailing Fama-French momentum alphas estimated from equation (3) using 36-months windows, thus results cover July 1990 to June 2007. Also, we give 95%-confidence bands (dashed lines). The upper graphs refer to the price momentum strategy, the lower graphs refer to the earnings momentum strategy, respectively.
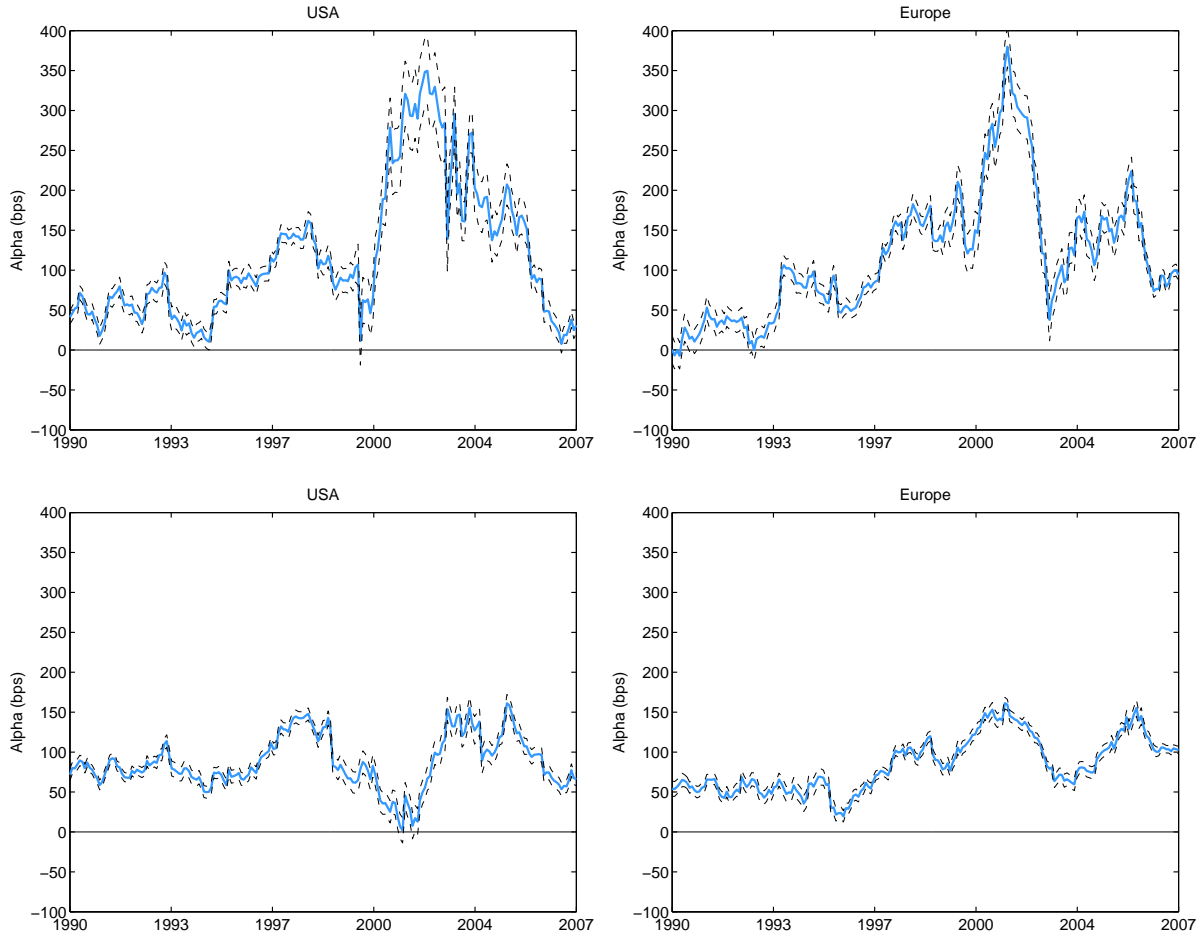
Figure 3. Momentum: Fama-French versus Four-Factor Alphas

In the upper graphs we plot trailing price momentum alphas arising from equations (3) and (4) using 36-months windows, thus results cover July 1990 to June 2007. Likewise, the lower graphs gove trailing earnings momentum alphas arising from equations (3) and (5). The dashed line gives the Fama-French alpha and the solid line is the respective four-factor alpha.